Tolomatic
EXCELLENCE *IN MOTION*®

USER GUIDE

SmartActuator Series

Integrated Control

Rod Style Actuator & Motor

ICRSV1B	BASIC
ICRSV1P	PLUS
ICMSV1P	PLUS

2100-4001_04

LINEAR SOLUTIONS MADE EASY

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Health and Safety Regulations

Read completely through the applicable sections of the manual before the equipment is unpacked, installed or operated. Pay careful attention to all of the dangers, warnings, cautions and notes stated in the manual.

Serious injury to persons or damage to the equipment may result if the information in the manual is not followed.

Safety Symbols

Items that are specifically marked DANGER!, WARNING!, CAUTION! or NOTE! are arranged in a hierarchical system and have the following meaning:

DANGER!

Indicated a very hazardous situation which, if not avoided, could result in death or serious injury. This signal word is limited to the most extreme situations.

WARNING!

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION!

Indicates a potentially hazardous situation which, if not avoided, may result in property damage, minor or moderate injury.

CAUTION!

Indicates hot surfaces. Avoid contact.

NOTE!

Information that requires special attention is stated here.

EMC Wiring Guidelines

Cable routing

It is recommended that the power and signal cables for ICR actuators be routed as far apart as possible to minimize system noise.

NOTE! The standard cables from Tolomatic are not flex rated and have a minimum bend radius of 3.75 inches. Any repeated flexing or excessive bending can result in broken conductors and intermittent faults.

Shielding and grounding

When cabling the system, shielded cables are recommended. The standard cables provided by Tolomatic have an overall shield with drain wires and the case ground of the actuator is tied to a pin on the power connector. To minimize EMI and ensure system reliability, all shield drain wires from all cables should be tied to a common earth ground.

Proper and Safe Use of Product

Protection circuits and external fuses

A fuse should be added to the input power line to protect the actuator and power supply from any potential over current conditions that may occur. In addition, if regenerative energy will be present (especially in vertical applications), a means for protecting against over voltage conditions should be implemented with a shunt regulator or sufficient bulk capacitance.

WARNING!

The manufacturer takes no responsibility whatsoever if the equipment is modified or if the equipment is used in any way beyond performance specifications. Unauthorized modifications or changes to the equipment are strictly forbidden and voids all warranties.

Fail Safe e-Stop Recommendations

A means for a fail safe e-stop is highly recommended to ensure equipment and personal safety. The e-stop should provide a means to remove main power from the actuator to cease and prevent any unwanted motion.

Device Damage Prevention

To prevent permanent damage to the device, proper care should be taken not to exceed published voltage, current, temperature, and load ratings. In addition, proper wiring should be verified and safety measures checked before applying power.

Personal Safety

During normal operation the actuator can become hot, especially the motor housing. It is highly recommended to display proper safety notices and implement proper safety measures to prevent contact with hot surfaces. In addition, the case ground should be tied to an earth ground to prevent the presence of case voltage.

Handling and Unpacking

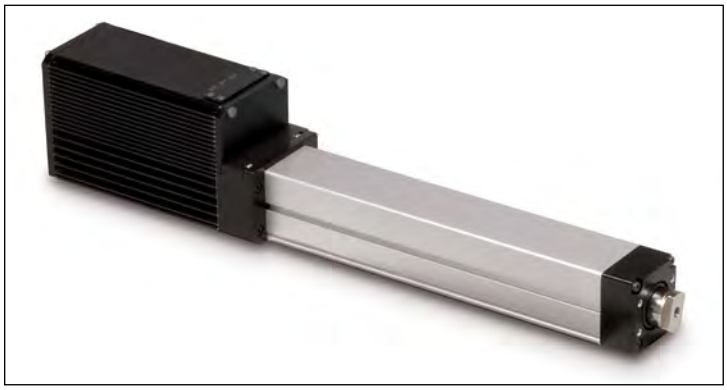
When unpacking and handling the actuator, care should be taken not to drop the actuator as this can damage the connectors, internal electronics, or knock the actuator out of alignment. Since this is an electromechanical device, proper ESD measures should be taken to avoid static electricity from contacting the signal and power lines of the device.

1.1 The ICR SV1B Basic and ICR/ICM SV1P Plus SmartActuators

Tolomatic's ICR rod-style SmartActuators offer all-in-one control with a controller, drive, and motor integrated in one compact easy to use component.

Both SV1B Basic and SV1P Plus actuators provide 100% duty cycle for continuous operation.

1.1.1 SV1B Basic Overview



Capabilities

- 2-position extend / retract
- Independent extend / retract speed control
- Mid-stroke positioning with sensors
- Force control / limiting
- 100% duty cycle for continuous operation
- 4 inputs, Enable, E-Stop, Fwd., Rev.
- 2 outputs, 24V line driver; fault, in-position
- 24 Vdc opto-isolated inputs, NPN or PNP
- IP65 option - For protection against water and dust ingress

Modes of Operation - The ICR Basic needs only a 24 or 48 Vdc power supply and a logic device for operation.

Setup Procedure

1. Mount the ICR Basic actuator to suit the application requirements.
2. Wire the 24 or 48 Vdc power supply to the actuator. See Section 4: Power Supply Recommendations.
3. Wire *Extend*, *Retract*, *Enable*, *E-Stop* inputs and *In-Position/Fault* output cables to the desired logic device. See Section 2: ICR SV1B Basic - Electrical Interface, Specs & Wiring.
4. Program the logic device.
5. Adjust the retract, extend and force output with a screwdriver via the controls

on the face of the motor/drive housing. See pages 5-6 and 5-7.

1.1.2 SV1P Plus Overview

Capabilities

- Indexer programming
- Stand-alone operation
- Infinite positioning
- Network communication

– Optional CANopen – DeviceNet

– RS-232 to Optional CANopen

- Stepper mode (Pulse / direction)
- Analog position mode
- 100% duty cycle for continuous operation
- 8 inputs
- 2 outputs, opto-isolated sinking/sourcing
- 24 Vdc opto-isolated input, NPN or PNP
- IP65 option - For protection against water and dust ingress

Modes of Operation

1. *Stand-alone mode:* Logic device or switches/sensors send commands to the actuator via digital I/O to invoke indexer program for motion or other logic events.
2. *Communication mode:* Logic device sends position commands or register changes over RS-232, optional CANopen, or DeviceNet. Multiple actuators can be controlled simultaneously (127 with CANopen and 63 with DeviceNet) via daisy chain. The RS-232 port can also be used as a gateway to the optional CANopen bus. A Microsoft® COM object library is provided to easily utilize the

power of optional CANopen through Windows® development in VB, C++, .NET, LabView, and other programming languages.

3. *Stepper mode:* Logic device sends pulse/direction commands to actuator initiating motion.
4. *Analog position mode:* Logic device sends 0-10 Vdc analog signal to actuator which equates to an actual position.

Setup Procedure

The mode of operation will determine the proper wiring and cabling of the actuator. Refer to the following sections of this manual for details on cabling, wiring and setup procedures:

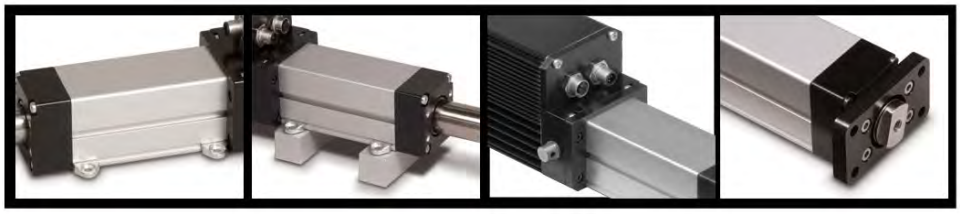
Section 3: ICR/ICM SV1P Plus - Electrical Interface, Specs & Wiring

Section 4: Power Supply Recommendations

The ICR Plus actuator utilizes Copley Controls Corporation drive and control components and their CME 2® User Interface software for programming. Refer to Section 6: How to Use the ICR/ICM SV1P Plus for setup and programming details.

1.1.3 ICR Options

Mounting Options



ICR SmartActuators can be mounted to an application via tube clamps, mounting plates, trunnion mounts, or front flange. The actuator also has threaded holes on the underside of the actuator heads that can be used for direct mounting.

Rod End Options

Both the Basic and Plus models offer externally threaded, clevis, rod eye, and alignment coupler rod end options.

Brake Option

Tolomatic offers a spring-applied, electronically-released brake at the time of ordering for applications with vertical orientation, heavy load requirements, and energy savings when the actuator is not in use. Refer to page 2-8 for the ICR Basic and page 3-11 for the ICR Plus brake option details.

Cable Options

Tolomatic also provides 5-meter signal and power cables for both the ICR Basic and ICR Plus. An additional communication cable is available in either 1-meter or 5-meter lengths for the ICR Plus. All cables are available in either standard or IP65.

Starter Kit - ICR Plus Only

Tolomatic offers a Starter Kit (Part No. 2180-9100) for use with optional CANopen, USB computer connections and multi-actuator applications. The kit includes:

USB to CAN converter (3604-1627)

Adapter cable for USB to CAN converter (3604-1626)

Male terminator resistor (3604-1653)

Switches

Switches are available in reed, solid state PNP or NPN, in normally open or normally closed.

1.1.4 ICR Mechanical Specifications

		Unit	BN02	BN05
Screw Type			Ball	Ball
Screw Pitch		tpi	2	5
Screw Diameter		in	0.75	0.63
		mm	*19.1*	*15.9*
Screw Lead		in/rev	0.500	0.200
		mm/rev	*12.70*	*5.08*
Screw Static Load		lbf	21,000	6,250
		N	*93,413*	*27,801*
Screw Dynamic Load		lbf	3,400	825
		N	*15,124*	*3,670*
Back Drive Force*		lbf	7.5	12.5
		N	*33.4*	*55.6*
Accuracy		in/ft	0.003	0.003
		mm/m	*0.02*	*0.02*
Backlash		in	0.015	0.015
		mm	*0.38*	*0.38*
Maximum Thrust	**Peak** **LMI 1:1**	lbf	150	400
		N	*667*	*1779*
	Peak **RP 1:1**	lbf	142.5	360
		N	*633.9*	*1601*
	Peak **RP 2:1**	lbf	285	720
		N	*1267.7*	*3202.7*
	Continuous **LMI 1:1**	lbf	80	215
		N	*356*	*956*
	Continuous **RP 1:1**	lbf	76	193.5
		N	*338*	*860.7*
	Continuous **RP 2:1**	lbf	152	387
		N	*676*	*1721.5*
Max Stroke		in	24	24
		mm	*609.6*	*609.6*
Base Weight LMI		lb	9.31	7.77
		kg	*4.22*	*3.52*
Base Weight RP, 1:1		lb	11.79	10.25
		kg	*5.35*	*4.65*
Base Weight RP, 2:1		lb	11.99	10.45
		kg	*5.44*	*4.74*
Weight/unit of stroke		lb/in	0.345	0.313
		kg/mm	*0.0062*	*0.0056*
Min temp**		deg F	50	50
		deg C	*10*	*10*
Max temp**		deg F	122	122
		deg C	*50*	*50*
NOTE: Performance de-rating will be necessary at ambient temperatures greater than 25 deg. C (77 deg F)				
IP rating		std	40	40
IP rating		option	65	65
Max Anti-Rotate Tolerance		degrees	±0.25 to ±1.25	

RoHS COMPLIANT RoHs Compliant Components

CE Approval Pending

* In vertical applications an unpowered ICR actuator will require a brake to maintain position if the load on the actuator exceeds this value. The brake option must be requested at the time the actuator is ordered as it requires factory installation. See page 2-8 for the ICR SV1B Basic and page 3-11 for the ICR/ICM SV1P Plus for brake specifications and requirements.

** Performance de-rating will be necessary at ambient temperatures greater than 77° F (25° C).

1.1.5 ICR Speed and Thrust Curves

Refer to the charts below for the continuous and peak thrust and speed capabilities of the screw selections.

NOTE: ICR rod-style SmartActuators are designed to push guided and supported loads and are not designed for applications that require significant side loading. Please contact Tolomatic at 1-800-328-2174 or 763-478-8000 for details regarding side loading capabilities.

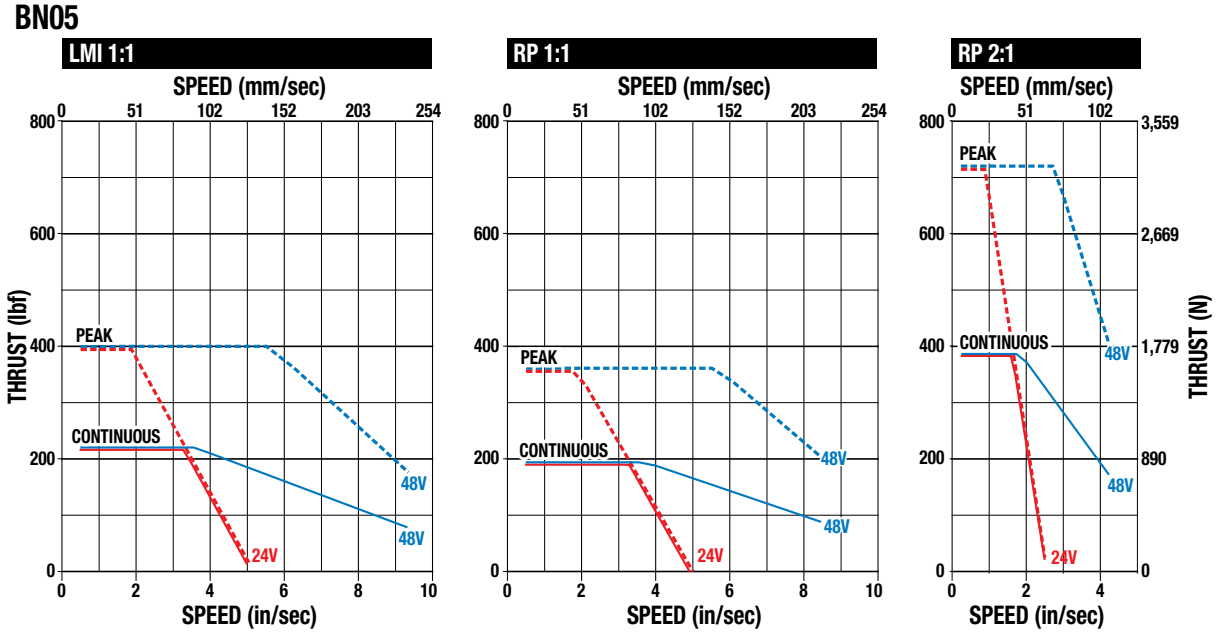


Figure 1-1: BN05 Ball Nut: Continuous and Peak Speed vs Thrust

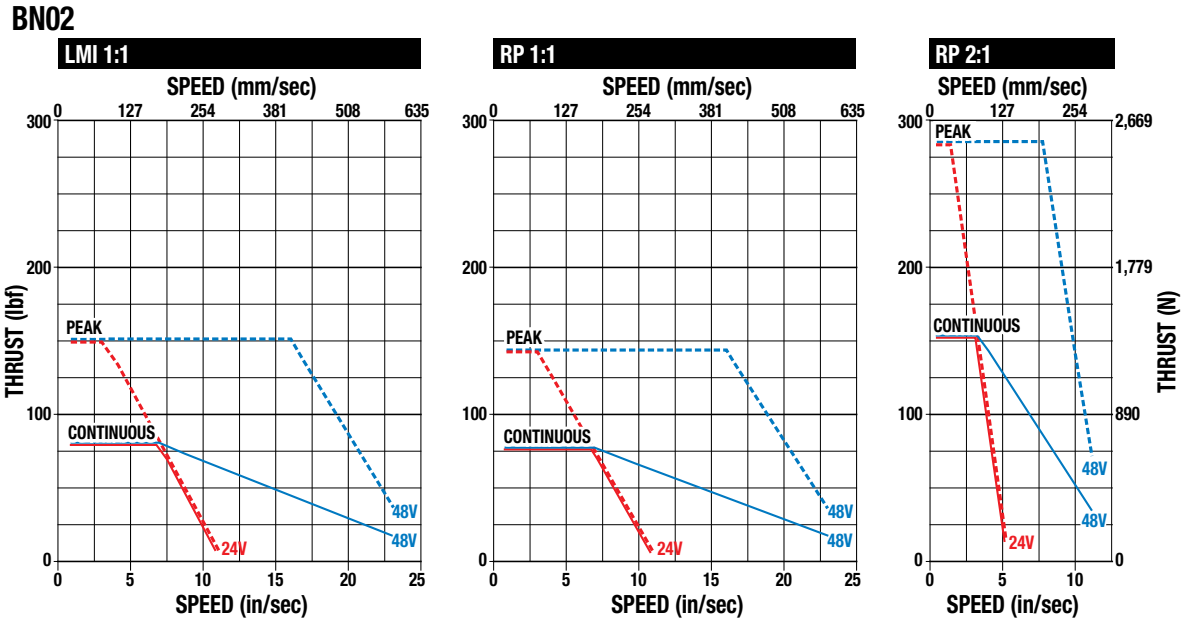


Figure 1-2: BN02 Ball Nut: Continuous and Peak Speed vs Thrust

1.1.6 RMS Thrust and Velocity Considerations

Servo motor actuator systems have two speed/thrust curves: one for continuous duty operation and another for intermittent duty. A servo system can be selected according to the total thrust and maximum velocity indicated by the continuous duty curve. However, by calculating the root mean square (RMS) thrust based on the application duty cycle, you may be able to take advantage of the higher peak thrust available in the intermittent duty range. The RMS thrust must fall within the continuous duty region of the motor/drive and the application maximum thrust must fall under the peak thrust of the actuator.

Use the following formulae when calculating the RMS thrust and velocity. When selecting an integrated servo actuator system, it is necessary to add a margin of safety to the thrust and velocity required to move the load. The recommended margin for servo motors is 15%.

$$\mathbf{T}_{RMS} = \sqrt{\frac{\text{sum } (\mathbf{T}_i^2 \text{ x } \mathbf{t}_i)}{\text{sum } (\mathbf{t}_i)}}$$

$$\mathbf{V}_{RMS} = \sqrt{\frac{\text{sum } (\mathbf{V}_i^2 \text{ x } \mathbf{t}_i)}{\text{sum } (\mathbf{t}_i)}}$$

Where:

$\mathbf{T}_{RMS}$ = RMS Thrust

$\mathbf{V}_{RMS}$ = RMS Velocity

$\mathbf{T}_i$ = Thrust during interval i

$\mathbf{V}_i$ = Velocity during interval i

$\mathbf{t}_i$ = Time interval i

1.1.7 ICR Screw Life

The L10 expected life of a ball screw linear actuator is expressed as the linear travel distance that 90% of properly maintained ball screws manufactured are expected to meet or exceed. This is not a guarantee and the graph in Figure 1-3 should be used for estimation purposes only. All curves represent properly lubricated and maintained actuators.

The underlying formula that defines this value is:

$$\mathbf{L}_{10} = \left(\frac{\mathbf{C}}{\mathbf{F}}\right)^3$$

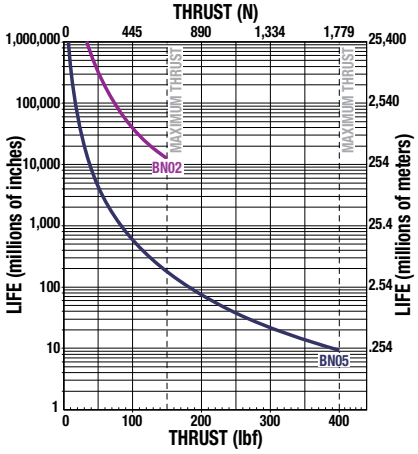
$\mathbf{L}_{10}$ = millions of inches

Where:

C = Dynamic load rating (lbf)

F = Cubic mean applied load (lbf)

LMI & RP 1:1 Ratio



RP 2:1 Ratio

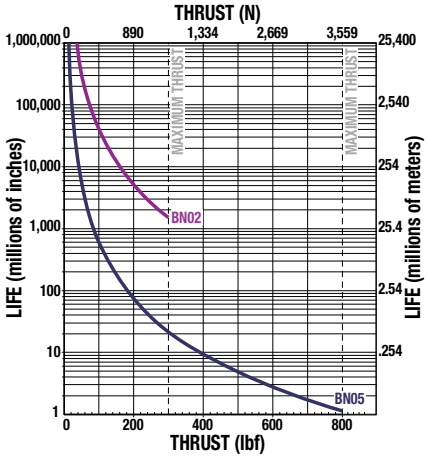


Figure 1-3: ICR Ball Screw Life

1.1.8 ICR System Critical Speed

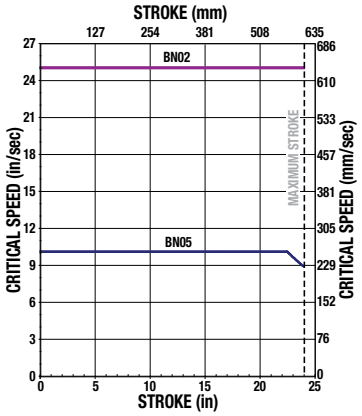


Figure 1-4: ICR SystemCritical Speed

1.1.9 ICR Side Load Considerations

Rod screw actuators are designed to push guided and supported loads and are not designed for applications that require significant side loading. Contact Tolomatic for details regarding side loading capabilities.

1.1.10 Brake Considerations

An unpowered ICR will require a brake to maintain its position if the force on the actuator exceeds: BN02 screw - 7.5 lbf (33.4 N); BN05 screw - 12.5 lbf (55.6 N)

A brake can be used with the actuator to keep it from backdriving, typically in vertical applications. A brake may be used for safety reasons or for energy savings allowing the actuator to hold position when unpowered. Add S A B to the ordering code for the optional Spring-Applied/Electronically-Released Brake. (not available for service part ordering)

NOTE: The optional Spring-Applied/Electronically-Released Brake requires 24V power. It has a input current rating of 0.414 Amps.

1.1.11 ICM Plus Mechanical Specs

	Unit	ICM
Peak Torque	in-lb	17
	N-m	*1.92*
Cont. Torque	in-lb	8.0
	N-m	*0.9*
Base Weight	lb	6.50
	kg	*2.95*
Min temp	deg F	50
	deg C	*10*
Max temp	deg F	122
	deg C	*50*
NOTE: Performance de-rating will be necessary at ambient temperatures greater than 25 deg. C (77 deg F)		
IP rating	std	40
IP rating	option	65
RoHS COMPLIANT RoHs Compliant Components		
CE Approval Pending		

1.1.12 ICM Plus Motor Speed vs Torque

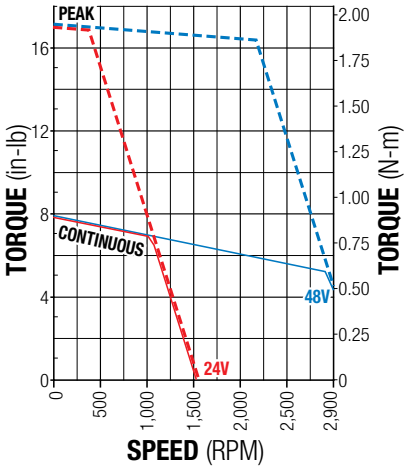


Figure 1-5: ICM Plus Motor Speed vs Torque

Test conditions: Motor operated at rated temperature mounted to an aluminum heatsink. Aluminum heatsink: 11" x 11" x ½"

2.1 Cabling and Connectors - ICR SV1B Basic Actuator

Tolomatic cables are available in standard and IP65 classifications. When using cables other than those provided by Tolomatic, reference the cable mating connector style to ensure the proper cabling is supplied to the ICR actuator.

CAUTION!

Reversing polarity of the input power will damage the actuator drive mechanism.

2.1.1 Power Cables and Pin-outs

CABLE	TOLOMATIC PART NO.	CONNECTOR ON ACTUATOR	MATING CONNECTOR* ON CABLE
Power: Std., 5 meter	3604-1641	Conec: 3003W3PXX99A10X	Conec: 3003W3SXX99A10X*
Power: IP65, 5 meter	3604-1649	Amphenol: PT02E12-3P(027)	Amphenol: PT06E12-3S(476)
Socket contacts: Std.	NA	Conec: 131C10029X	Conec: 132C10029X

* This type of mating connection is used on Tolomatic supplied cables. Reference this type of mating connector for customer designed cables.

PIN NUMBERS			
STD.	IP65	DESCRIPTION	CABLE WIRE COLOR
A1	A	+24-48 Vdc Power	Red
A2	B	Case / Shield Ground	Bare Wire
A3	C	Power Ground	Black

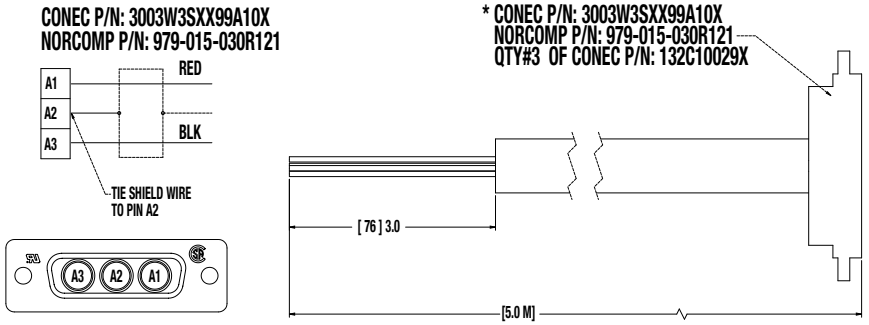


Figure 2-1: ICR SV1B Basic Actuator Standard Power Cable 3604-1641

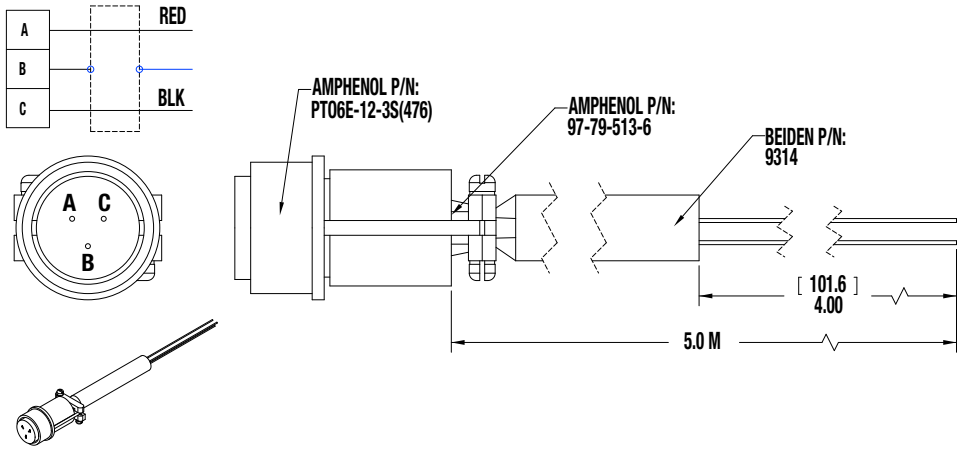


Figure 2-2: ICR SV1B Basic Actuator IP65 Power Cable 3604-1649

2.1.2 I/O Cables and Pin-outs

CABLE	TOLOMATIC PART NO.	CONNECTOR ON ACTUATOR	MATING CONNECTOR* ON CABLE
I/O: Std., 5 meter	3604-1640	Norcomp: 171-025-103L001	Norcomp: 171-025-203L001
I/O: IP65, 5 meter	3604-1648	Amphenol: PT02E16-26P(027)	Amphenol: PT06E16-26S(476)

* This type of mating connection is used on Tolomatic supplied cables. Reference this type of mating connector for customer designed cables.

PIN NUMBERS				
STD.	IP65	DESCRIPTION	CABLE WIRE COLOR	TECHNICAL INFO. PAGE NO.
1	A			
2	B			
3	C			
4	D			
5	E			
6	F			
7	G			
8	H			
9	J	Enable	Orange/Black	2-5
10	K	E Stop	Red/White	
11	L			
12	M	Extend Command	Blue/White	2-5
13	N	Input Common	White/Black/Red	
14	P	Retract Command	White/Red	
15	R			
16	S			
17	T			
18	U	In Position Output	Green/Black/White	2-7
19	V	Ground**	Green/Black	
20	W	Fault Output	Black/White/Red	
21	X	Ground**	Black/White	
22	Y	+24 V Brake Power Input	Red/Black	2-8
23	Z	Ground**	Black/Red	
24	a	+24 V Keep Alive	Red	2-9
25	b	Ground**	Black	

** Signal grounds not needed for operation. Grounds on signal connector are common to ground or power connector. It is recommended to leave thee unconnected unless specifically required for the application.

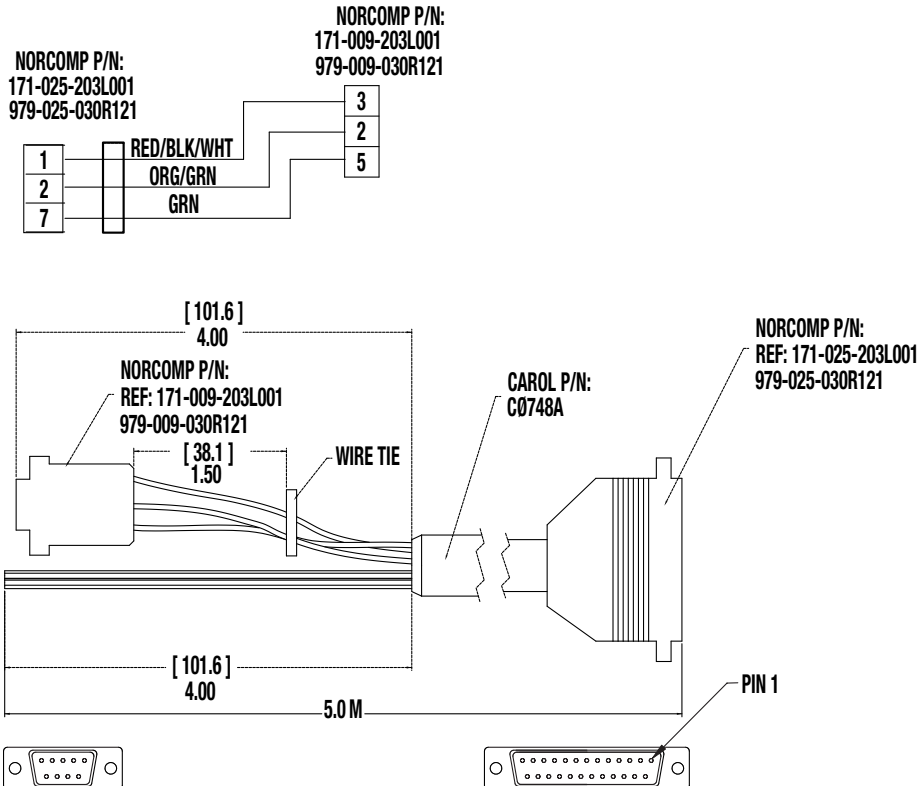


Figure 2-3: ICR SV1B Basic Actuator Standard I/O Cable 3604-1640

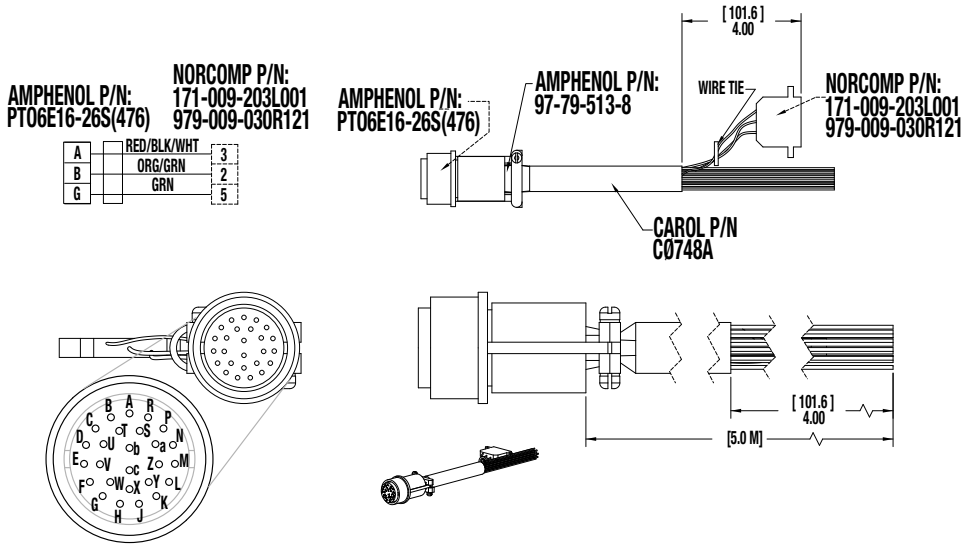


Figure 2-4: ICR SV1B Basic Actuator IP65 I/O Cable 3604-1648

2.1.3 Cable Routing

Over time, liquid contaminants such as oil and cleaning solutions may accumulate on the cables and in the connectors if they are an exposed type. To minimize the introduction of contaminants into the connector, route the cables so that there is a loop in the cable just prior to its attachment to the connector.

Two examples are shown below depending on the orientation of the connectors. Units mounted in such a way that the connectors are on the bottom surface of the actuator require no looping.

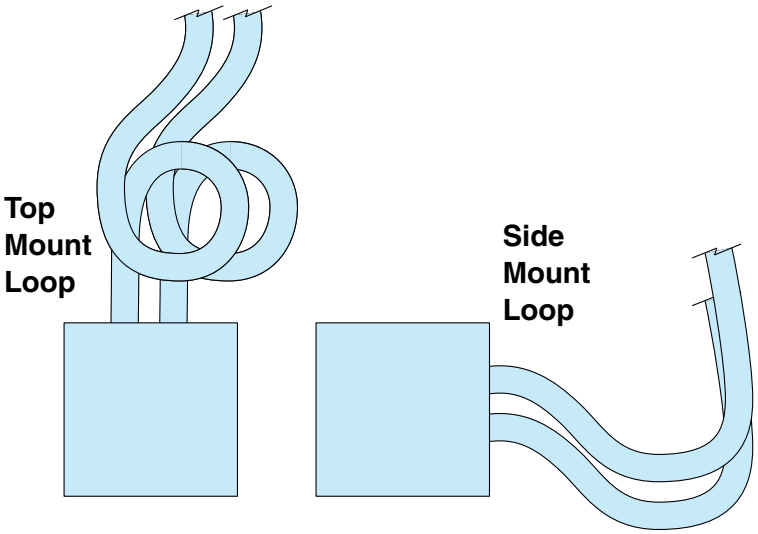


Figure 2-5: Cable Routing for Top and Side Mounted Connectors

2.2 Digital Inputs – ICR SV1B Basic Actuator

The ICR SV1B Basic actuator has a total of 8 digital inputs / 4 are spare and not implemented. These digital inputs are opto-isolated from the actuator's drive circuitry and can be wired as either sinking or sourcing. All of the digital inputs have a common return. Figure 2-6 shows the circuit diagram for the interface.

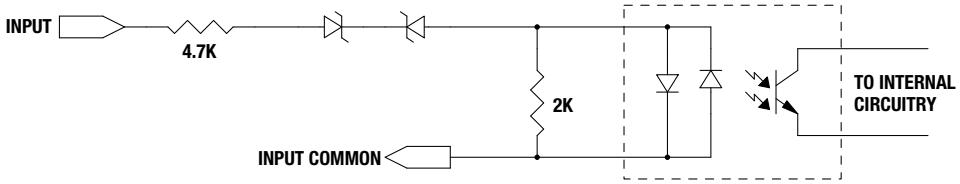


Figure 2-6: ICR SV1B Basic Actuator Interface Circuit Diagram

CAUTION!

The E-stop input is software controlled; it is highly recommended to have an external E-stop hardware measure to ensure safety.

ICR SV1B Basic Actuator Digital Input Specifications	
Input Voltage Range	0 to 30 Vdc
On State Voltage Range	16 to 30 Vdc
Off State Voltage Range	0 to 5 Vdc
On State Current: 16 Vdc (minimum) 24 Vdc (nominal) 30 Vdc (maximum)	 1.9 mA 3.6 mA 4.9 mA
Nominal Input Impedance (24V)	6.7K Ohm
Off State Current (maximum)	0.4 mA
Update Rate (maximum)	2 ms

ICR SV1B Basic Actuator Digital Input Functionality	
SIGNAL NAME	**DESCRIPTION**
Extend Command	Commands the actuator to move in the extend direction. Forward is defined as extend.
Retract Command	Commands the actuator to move in the retract direction. Reverse is defined as retract.
Enable	Enables the drive. Disabling the drive will turn off the amplifier and engage the brake if installed.
E-stop	Emergency stop. Removal of this signal will disable the drive and engage the brake if installed.

The remaining spare inputs and any designated inputs can be programmed at Tolomatic for custom applications. Please consult Tolomatic for custom applications.

2.2.1. Typical Wiring Connections

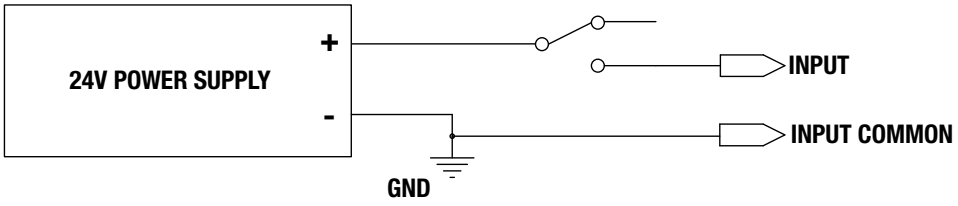


Figure 2-7: ICR SV1B Basic Actuator Input Source (switched) Connection

2.2.1. Typical Wiring Connections (cont.)

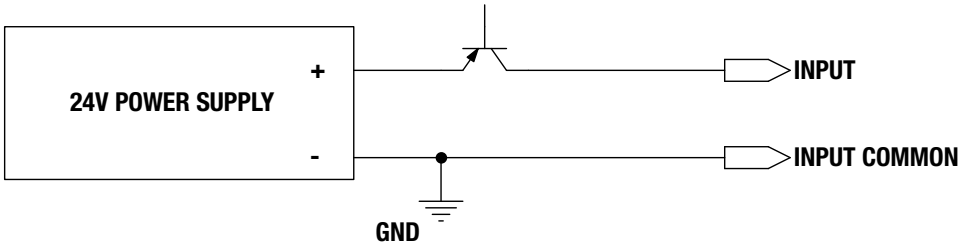


Figure 2-8: ICR SV1B Basic Actuator Input Source (PNP) Connection

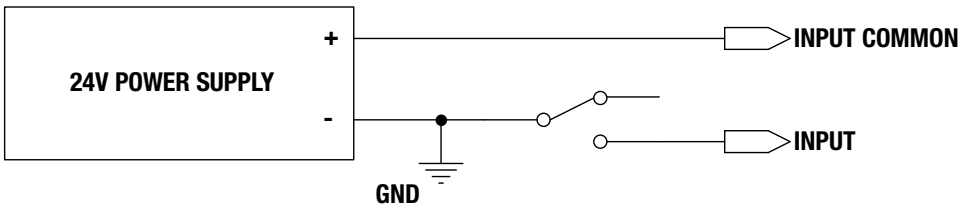


Figure 2-9: ICR SV1B Basic Actuator Input Sink (switched) Connection

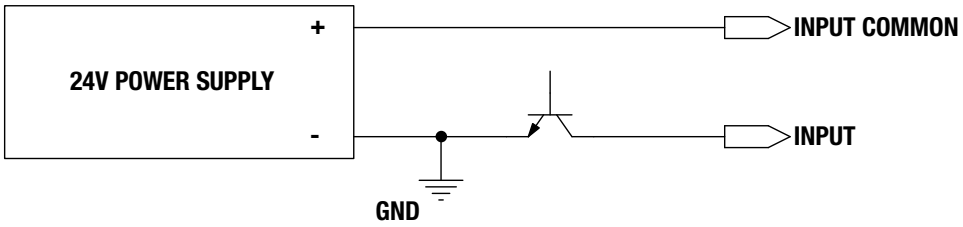


Figure 2-10: ICR SV1B Basic Actuator Input Sink (NPN) Connection

2.3 Digital Outputs – ICR SV1B Basic Actuator

The ICR SV1B Basic actuator has 3 digital outputs, 2 of them are implemented. The outputs are both sinking and sourcing and are protected against over current and short circuit conditions. Once an over current condition is present, the output turns off until the load is removed. The power is generated internally.

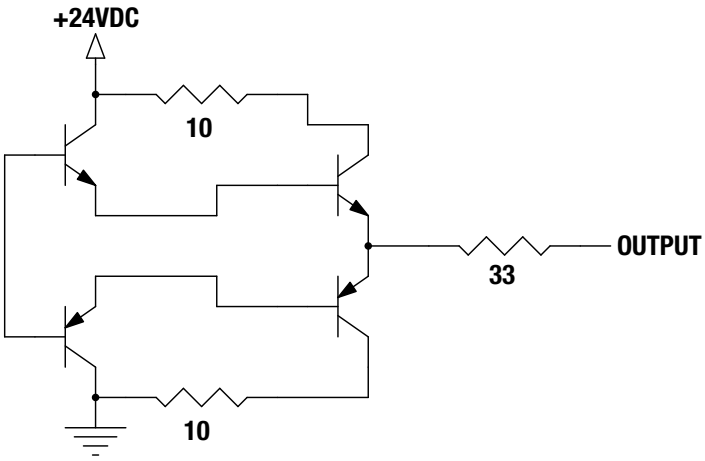


Figure 2-11: ICR SV1B Basic Actuator Output Interface Circuit Diagram

ICR SV1B Basic Actuator Digital Output Specifications	
Output high minimum (10 mA source), 24 V power	20 V
Output low maximum (10 mA sink)	2 V
Maximum continuous current	20 mA
Fold back current	85 mA
Maximum output sink / source voltage	24 V
Update rate	2 ms

ICR SV1B Basic Actuator Digital Output Functionality	
SIGNAL NAME	**DESCRIPTION**
In Position	Output will go high when the actuator is not moving.
Fault	Output will go high when an error is present.

The spare and any designated outputs can be programmed at Tolomatic for custom applications. Please consult Tolomatic for custom applications.

2.4 Optional Electronic Brake – ICR SV1B Basic Actuator

CAUTION!

Operating an ICR actuator with a brake installed without providing brake power can damage the brake and the actuator.

Tolomatic offers an optional spring-applied, electronically-released brake that can be used with the actuator to keep the actuator from back driving, typically in vertical applications. It can also be used for safety reasons or for energy savings allowing the actuator to hold position when unpowered. The drive is signaled to apply the brake which holds the actuator's position prior to disabling the actuator. The brake option is not a service part and must initially be ordered with the actuator as it is internally configured with the drive.

If a brake is installed in the actuator, a 24V power source is needed. The brake power is on pin 22 for the standard cable and on pin Y for IP65 cable. The return is on pin 23 for the standard cable and on pin Z for IP65 cable. See I/O Cable Pin-outs on page 2-2. The controller will automatically engage / disengage the brake using this power.

An unpowered ICR actuator will require a brake to maintain its position if the force on the actuator exceeds the following requirements:

BN02 screw: 7.5 lbf (33.4 N)

BN05 screw: 12.5 lbf (55.6 N)

Electronic Brake Power and Specifications	
Input Voltage (minimum)	21.6 Vdc
Input Voltage (nominal)	24 Vdc
Input Voltage (maximum)	26.4 Vdc
Input Current Maximum (at input voltage maximum)	0.414 Amps
Static Torque	12.5 in-lbs maximum

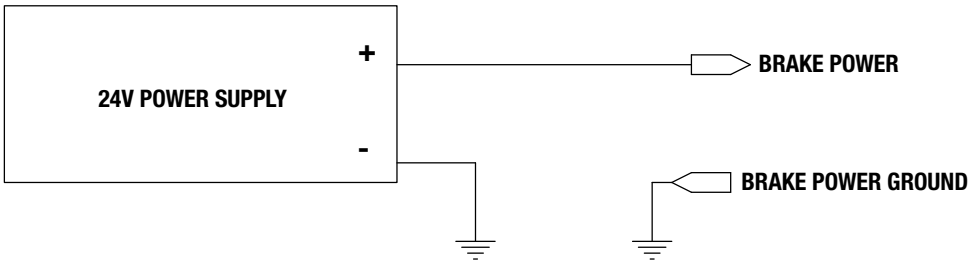


Figure 2-12: ICR SV1B Basic Actuator Optional Electronic Brake Connection

2.5 Input Power - ICR SV1B Basic Actuator

The ICR SV1B Basic actuator has the following drive ratings:

ICR SV1B Basic Actuator Internal Drive Specifications	
Current - Continuous maximum[1]	10 A
Current - Peak[1]	20 A
Voltage - Nominal	24-48 V
Over Voltage[2]	56 V
Under Voltage[3]	20 V
Absolute Maximum Voltage	59 V
Logic Current Draw Maximum (24V)[4]	0.11 A
Logic Current Draw Maximum (48V)[4]	0.09 A

[1] Continuous and peak current ratings are actual motor current and input power supply current. Achievable continuous current will depend on temperature.

[2] Drive will shut down at 56V; any voltage above the absolute max voltage can result in permanent damage.

[3] Drive will turn off below this voltage.

[4] Logic current for keep alive, no outputs active.

CAUTION!

Voltage above the absolute maximum can result in permanent damage to the ICR SV1B internal drive components.

The drive and logic (keep alive) power share the same ground. The actuator's drive logic circuitry can be powered from the keep alive input or the main drive power. The keep alive input voltage and the main power inputs have independent power supplies and do not require the same voltage for operation.

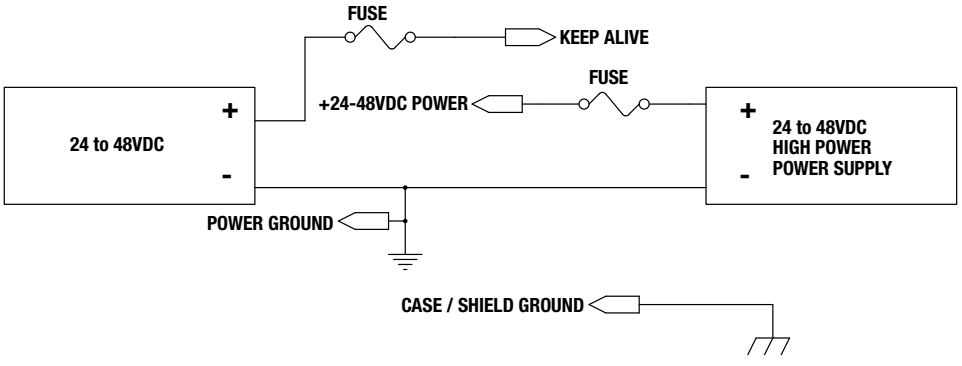


Figure 2-13: ICR SV1B Basic Actuator Logic and Main Power Supplies

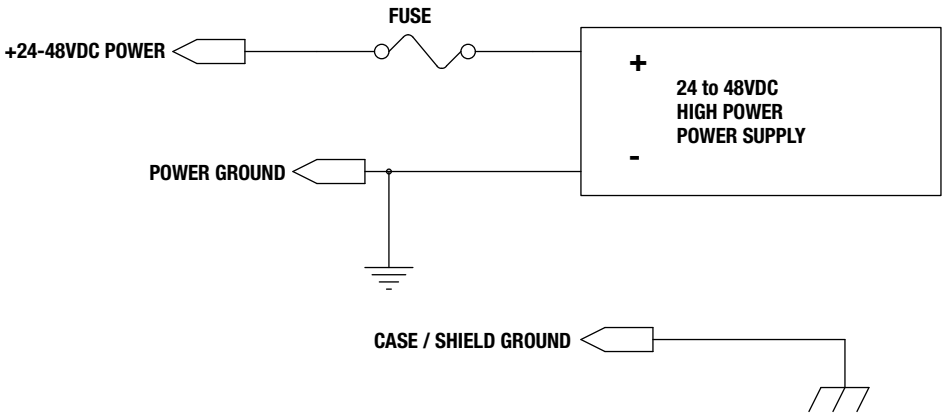


Figure 2-14: ICR SV1B Basic Actuator Single Supply - Main Power

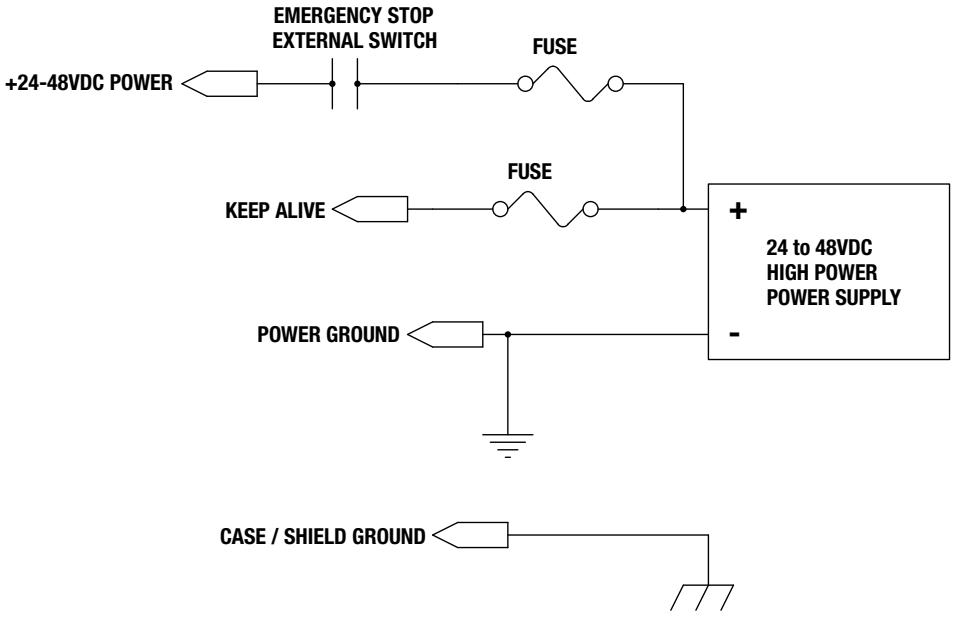


Figure 2-15: ICR SV1B Basic Actuator Single Supply - External Cut-off Switch for Emergency Stop

2.6 Environmental Conditions

ICR SV1B Basic Actuator Operating Environment	
Ambient Temperature	77˚ F, 25˚ C Nominal
Operating Temperature	50-122˚ F, 10-50˚ C [de-rate performance above 77˚ F (25˚ C)]
Storage Temperature	50-158˚ F, 10-70˚ C
Humidity	0-95% non-condensing
IP Rating	40 standard, 65 optional

2.7 ICR SV1B Basic Actuator Setup

Figure 2-16 shows the simple setup of the ICR Basic and the necessary cables and power source.

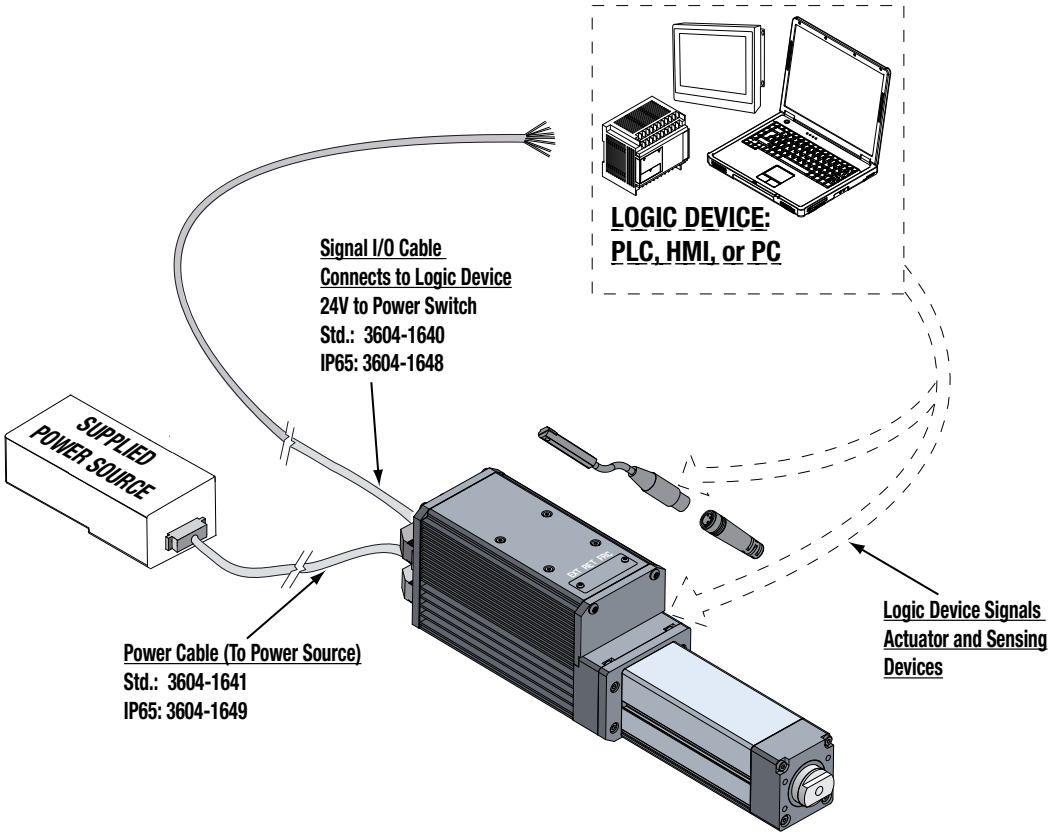


Figure 2-16: ICR SV1B Basic Actuator Setup

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3.1 Cabling and Connectors - ICR/ICM SV1P Plus

Tolomatic cables are available in standard and IP65 classifications. When using cables other than those provided by Tolomatic, reference the cable mating connector style to ensure the proper cabling is supplied to the ICR actuator.

CAUTION!

Reversing polarity of the input power will damage the actuator's internal drive mechanism.

3.1.1 Power Cables and Pin-outs

CABLE	TOLOMATIC PART NO.	CONNECTOR ON ACTUATOR	MATING CONNECTOR* ON CABLE
Power: Std., 5 meter	3604-1641	Conec: 3003W3PXX99A10X	Conec: 3003W3SXX99A10X*
Power: IP65, 5 meter	3604-1649	Amphenol: PT02E12-3P(027)	Amphenol: PT06E12-3S(476)
Socket contacts: Std.	NA	Conec: 131C10029X	Conec: 132C10029X

* This type of mating connection is used on Tolomatic supplied cables. Reference this type of mating connector for customer designed cables.

PIN NUMBERS			
STD.	IP65	DESCRIPTION	CABLE WIRE COLOR
A1	A	+24-48 Vdc Power	Red
A2	B	Case / Shield Ground	Bare Wire
A3	C	Power Ground	Black

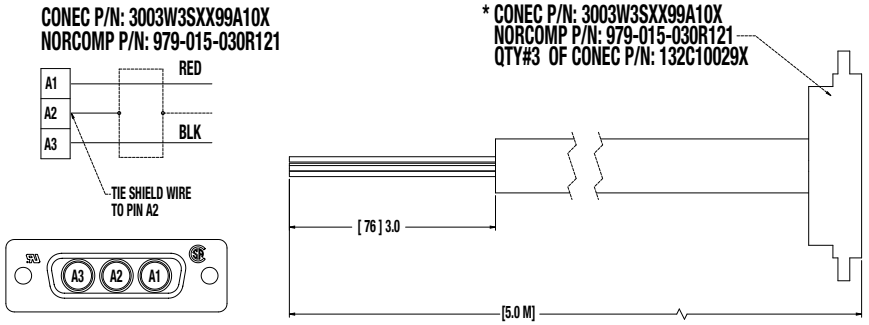


Figure 3-1: ICR/ICM SV1P Plus Standard Power Cable 3604-1641

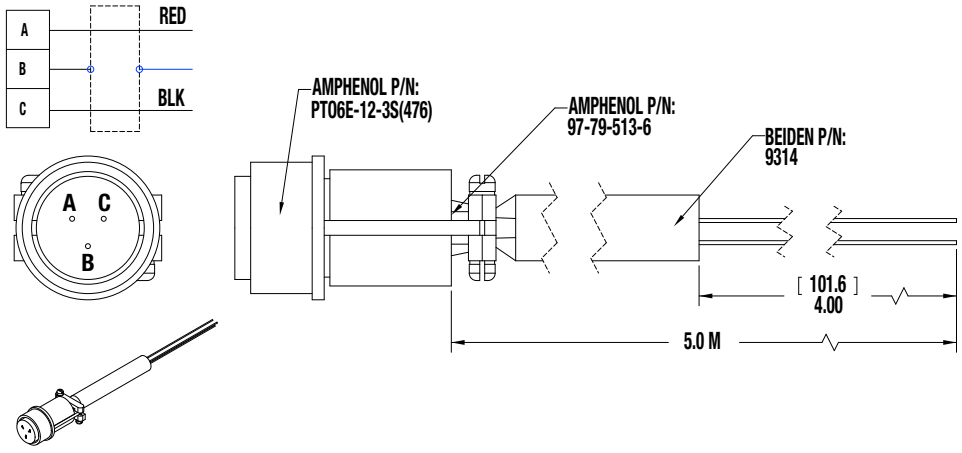


Figure 3-2: ICR/ICM SV1P Plus IP65 Power Cable 3604-1649

3.1.2 I/O Cables and Pin-outs

CABLE	TOLOMATIC PART NO.	CONNECTOR ON ACTUATOR	MATING CONNECTOR* ON CABLE
I/O: Std., 5 meter	3604-1640	Norcomp: 171-025-103L001	Norcomp: 171-025-203L001
I/O: IP65, 5 meter	3604-1648	Amphenol: PT02E16-26P(027)	Amphenol: PT06E16-26S(476)

* This type of mating connection is used on Tolomatic supplied cables. Reference this type of mating connector for customer designed cables.

PIN NUMBERS			
STD.	IP65	DESCRIPTION	CABLE WIRE COLOR
1	A	RS232 RX	Red/Black/White
2	B	RS232 TX	Orange/Green
3	C	Pulse	White
4	D	Direction	Orange
5	E	Reference in +	Blue
6	F	Reference in -	Blue/Black
7	G	Digital Ground	Green
8	H	Analog Ground	White/Black
9	J	In 1	Orange/Black
10	K	In 2	Red/White
11	L	In 3	Green/White
12	M	In 4	Blue/White
13	N	Input Common	White/Black/Red
14	P	In 6	White/Red
15	R	In 5	Orange/Red
16	S	In 8	Blue/Red
17	T	In 7	Red/Green
18	U	Digital Out 1+	Green/Black/White
19	V	Digital Out 1-	Green/Black
20	W	Digital Out 2+	Black/White/Red
21	X	Digital Out 2-	Black/White
22	Y	+24 V Brake Power Input	Red/Black
23	Z	Brake Power Input Ground	Black/Red
24	a	+24 V Keep Alive	Red
25	b	Ground	Black

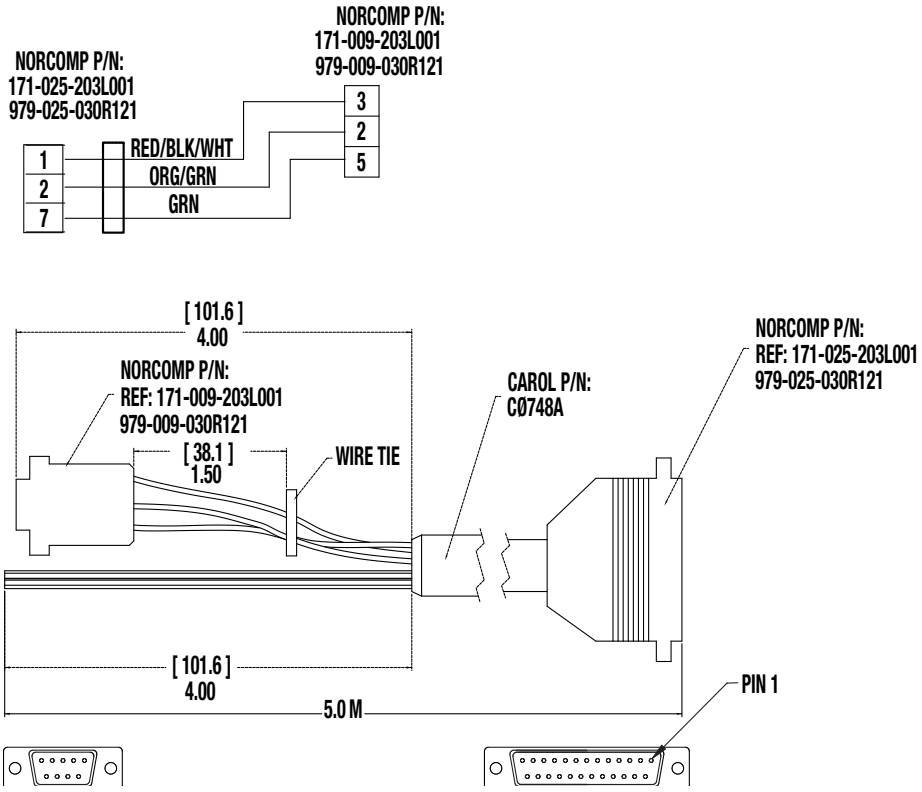


Figure 3-3: ICR/ICM SV1P Plus Standard I/O Cable 3604-1640

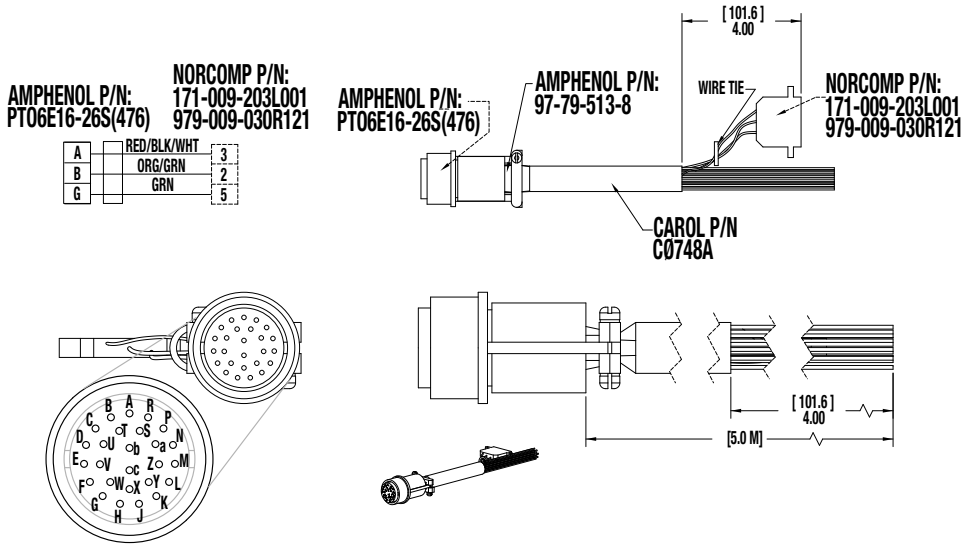


Figure 3-4: ICR/ICM SV1P Plus IP65 I/O Cable 3604-1648

3.1.3 Optional Communications Cable

A communications cable is available as an option with the ICR/ICM SV1P Plus actuator and can be used for daisy chaining a series of actuators together to a PLC, PC, HMI, or other intelligent device.

CABLE	TOLOMATIC PART NO.
Communication Cable: 1 Meter	3604-1659
Communication Cable: 5 Meter	3604-1660

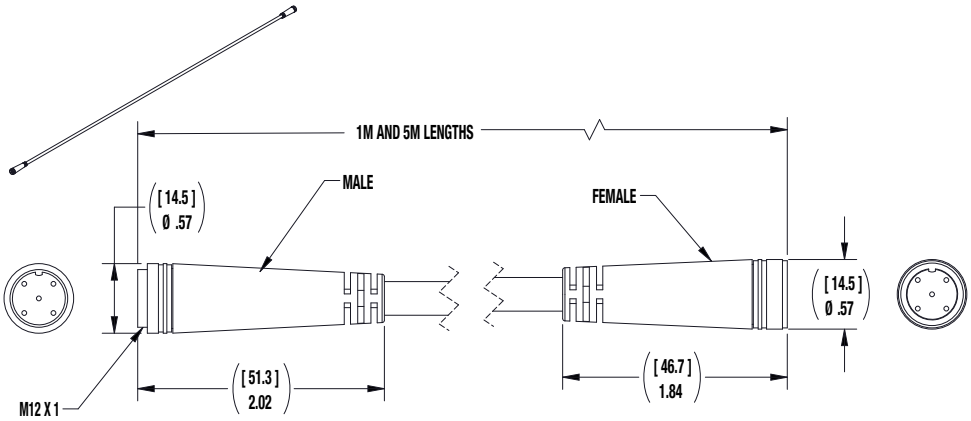


Figure 3-5: ICR/ICM SV1P Plus Optional Communications Cable

When cutting these cables for CANopen or DeviceNet connections, follow these wiring guidelines.

Wiring for CANopen	Wiring for DeviceNet
3 - Black, V- (CAN Ground)	1 - Drain, Shield
4 - White, CAN High	2 - Red, V+
5 - Blue, CAN Lo	3 - Black, V- (CAN Ground)
	4 - White, CAN High
	5 - Blue, CAN Lo

3.2 Digital Inputs - ICR/ICM SV1P Plus

3.2.1. Isolated Digital Inputs

The ICR/ICM SV1P Plus actuator has a total of 8 isolated digital inputs, which are programmable. The isolated digital inputs can be configured to be either sinking or sourcing. All of the isolated digital inputs have a common return and are isolated from the internal circuitry. Figure 3-6 shows the circuit diagram for the isolated interface.

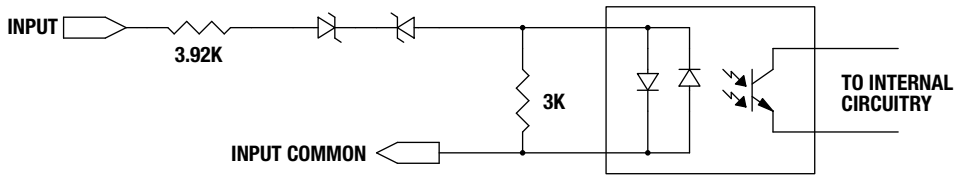


Figure 3-6: ICR/ICM SV1P Plus Isolated Interface Circuit Diagram

ICR/ICM SV1P Plus Isolated Digital Input Specifications	
Input Voltage Range	0 to 26 Vdc
On State Voltage Range	10 to 26 Vdc
Off State Voltage Range	0 to 4 Vdc
On State Current: 10 Vdc (minimum) 24 Vdc (nominal) 26 Vdc (maximum)	 1.5 mA 5 mA 5.5 mA
Nominal input impedance (24V)	4.8K Ohm
Off State Current (maximum)	0.4 mA
Update rate (maximum)	0.3 ms

3.2.2 High Speed Digital Inputs

The ICR/ICM SV1P Plus actuator has two high speed digital inputs for pulse / direction. These inputs are not isolated, accept TTL levels, and are referenced to digital ground.

CAUTION!

The E-stop input is software controlled, it is highly recommended to have an external E-stop hardware measure to ensure safety.

ICR/ICM SV1P Plus High Speed Digital Input Specifications	
Input Voltage Range	0 to 5.5 Vdc
Positive Going Threshold	3.5 Vdc
Negative Going Threshold	0.9 Vdc
Nominal Input Impedance (24V)	4.8K Ohm
Off State Current (maximum)	0.4 mA
Input Filter	100ns

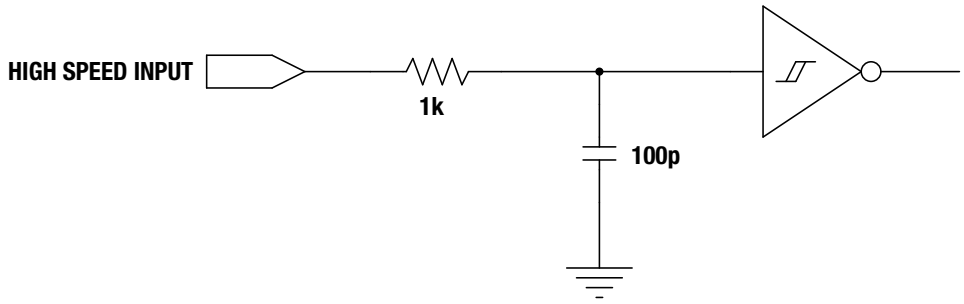


Figure 3-7: ICR/ICM SV1P Plus High Speed Digital Input Circuitry

3.2.3 Typical Wiring Connections

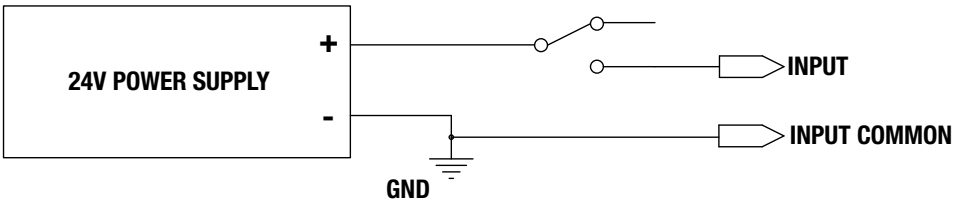


Figure 3-8: ICR/ICM SV1P Plus Source (switched) Connection

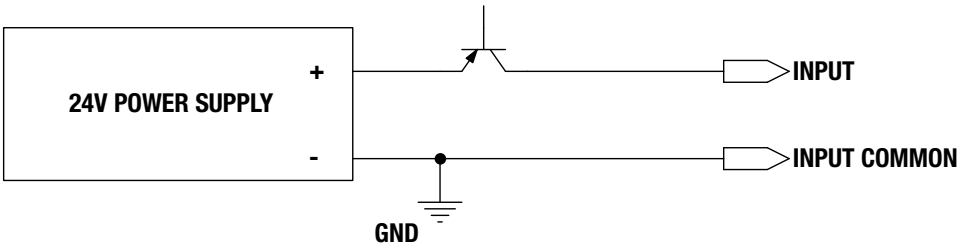


Figure 3-9: ICR/ICM SV1P Plus Source (PNP) Connection

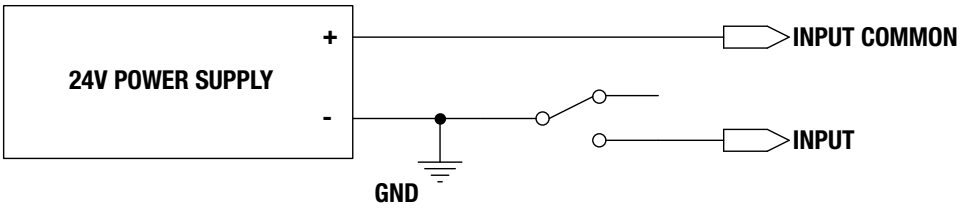


Figure 3-10: ICR/ICM SV1P Plus Sink (switched) Connection

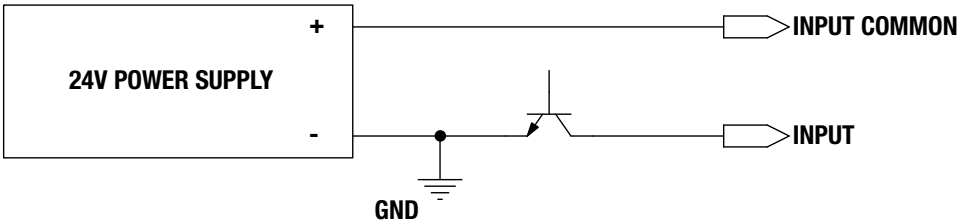


Figure 3-11: ICR/ICM SV1P Plus Sink (NPN) Connection

3.3 Analog Inputs - ICR/ICM SV1P Plus

The ICR/ICM SV1P Plus actuator has one programmable analog input.

ICR/ICM SV1P Plus Analog Input Specifications	
Input Voltage Maximum	+/- 15V
Input Voltage Full Scale (nominal)	+/- 10V
Input Impedance (nominal)	5K Ohm
Input Offset Voltage Maximum	+/- 10mV
Input Bias Current	+/- 1uA
Update Rate	62.5uS

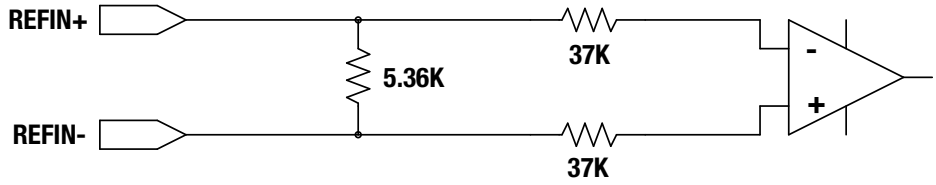


Figure 3-12: ICR/ICM SV1P Plus Analog Input Circuit

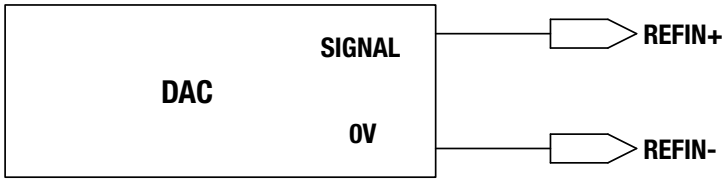


Figure 3-13: ICR/ICM SV1P Plus Analog Input Typical Wiring

3.4 Digital Outputs - ICR/ICM SV1P Plus

The ICR/ICM SV1P Plus actuator has two digital outputs, which are programmable. The outputs are opto-isolated from the drive circuitry and can be configured for sinking or sourcing. The outputs are protected against over current and short circuit conditions. Once an over current condition is present, the output turns off until the load is removed.

ICR/ICM SV1P Plus Digital Output Specifications	
Maximum Switched Voltage	30 V
Output low maximum (20 mA sink)	4 V
Maximum continuous current	20 mA
Fold back current	80 mA
Maximum output sink / source voltage	24 V
Update rate	1 ms
Output Leakage Current	10 uA

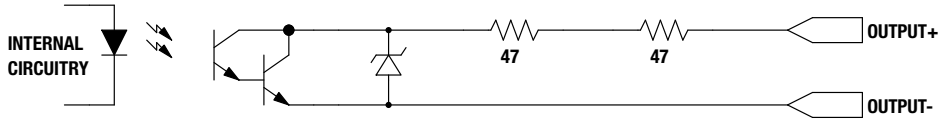


Figure 3-14: ICR/ICM SV1P Plus Digital Output Circuitry

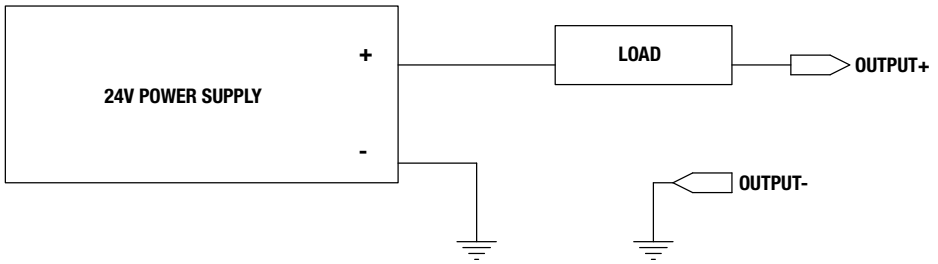


Figure 3-15: ICR/ICM SV1P Plus Digital Output Sinking Wiring Diagram

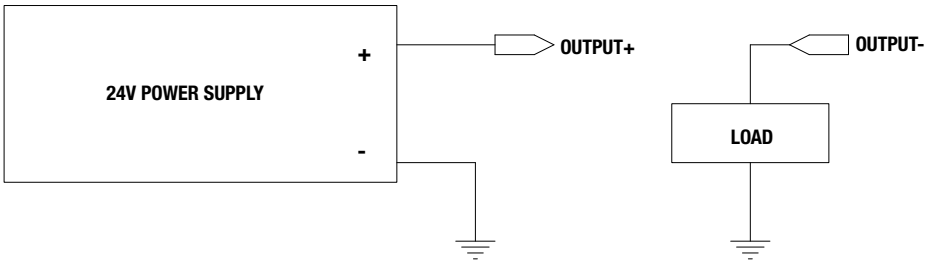


Figure 3-16: ICR/ICM SV1P Plus Digital Output Sourcing Wiring Diagram

3.5 Input Power - ICR/ICM SV1P Plus

The ICR/ICM SV1P Plus actuator has the following drive ratings:

ICR/ICM SV1P Plus Internal Drive Specifications	
Current - Continuous maximum[1]	10 A
Current - Peak[1]	20 A
Voltage - Nominal	24-48 V
Over Voltage[2]	56 V
Under Voltage[3]	20 V
Absolute Maximum Voltage	59 V
Logic Current Draw Maximum (24V)[4]	0.11 A
Logic Current Draw Maximum (48V)[4]	0.09 A

[1] Continuous and peak current ratings are actual motor current and input power supply current. Achievable continuous current will depend on temperature.

[2] Drive will shut down at 56V; any voltage above the absolute max voltage can result in permanent damage.

[3] Drive will turn off below this voltage.

[4] Logic current for keep alive, no outputs active.

CAUTION!

Voltage above the absolute maximum can result in permanent damage to the ICR SV1P internal drive components.

The drive and logic (keep alive) power share the same ground. Drive logic circuitry can be powered from the keep alive input or the main drive power. The keep alive input voltage and the main power inputs have independent power supplies and do not require the same voltage for operation.

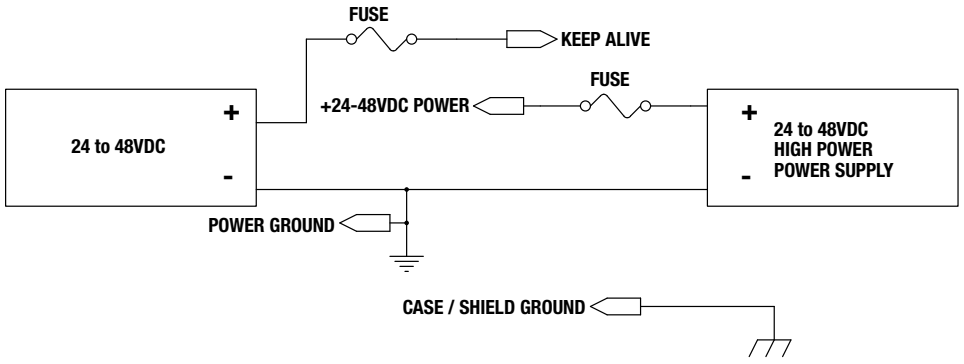


Figure 3-17: ICR/ICM SV1P Plus Logic and Main Power Supplies

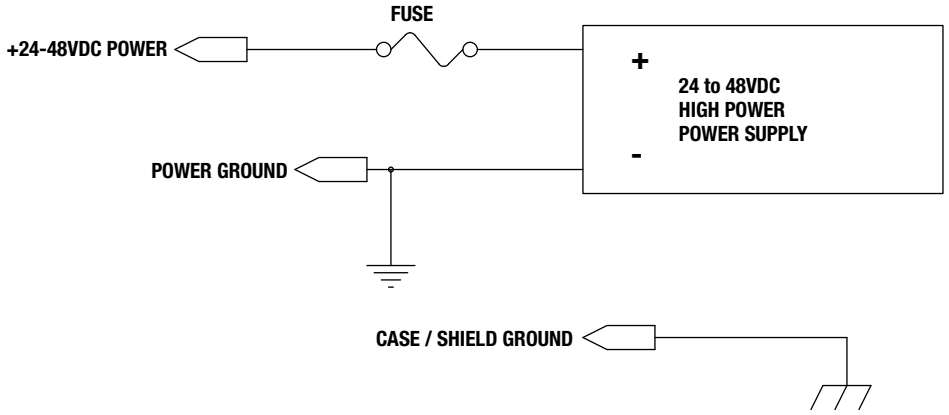


Figure 3-18: ICR/ICM SV1P Plus Single Supply - Main Power

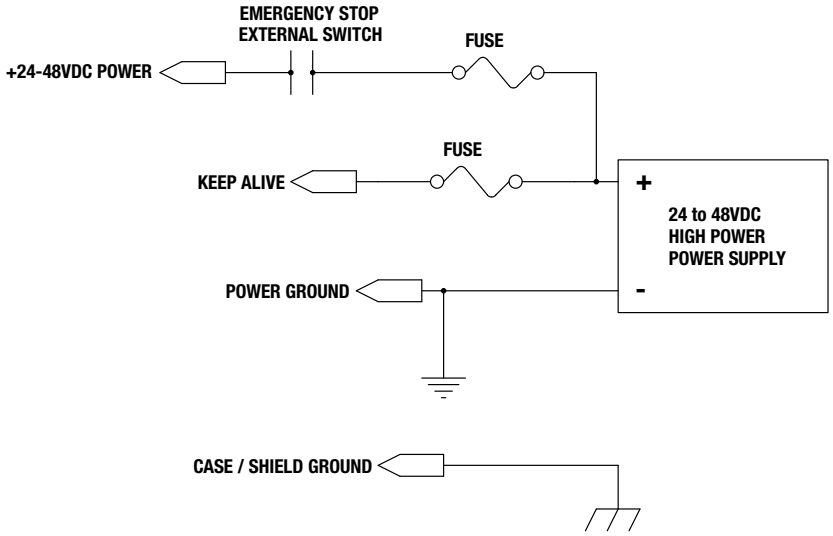


Figure 3-19: ICR/ICM SV1P Plus Single Supply - External Cutoff Switch for Emergency Stop

3.6 Optional Electronic Brake – ICR/ICM SV1P Plus

CAUTION!

Operating an ICR actuator with a brake installed without providing brake power can damage the brake and the actuator.

Tolomatic offers an optional spring-applied, electronically-released brake that can be used with the actuator to keep the actuator from back driving, typically in vertical applications. It can also be used for safety reasons or for energy savings allowing the actuator to hold position when unpowered. The drive is signaled to apply the brake which holds the actuator's position prior to disabling the actuator. The brake option is not a service part and must initially be ordered with the actuator as it is internally configured with the drive.

If a brake is installed in the actuator, a 24V power source will be needed. The brake power is on pin 22 for the standard cable and on pin Y for IP65 cable. The return is on pin 23 for the standard cable and on pin Z for IP65 cable. See I/O Cable Pin-outs on page 2-2. The controller will automatically engage / disengage the brake using this power.

An unpowered ICR actuator will require a brake to maintain its position if the force on the actuator exceeds the following requirements:

BN02 screw: 7.5 lbf (33.4 N)

BN05 screw: 12.5 lbf (55.6 N)

Electronic Brake Power and Specifications	
Input Voltage (minimum)	21.6 Vdc
Input Voltage (nominal)	24 Vdc
Input Voltage (maximum)	26.4 Vdc
Input Current Maximum (at input voltage maximum)	0.414 Amps
Static Torque	12.5 in-lbs maximum

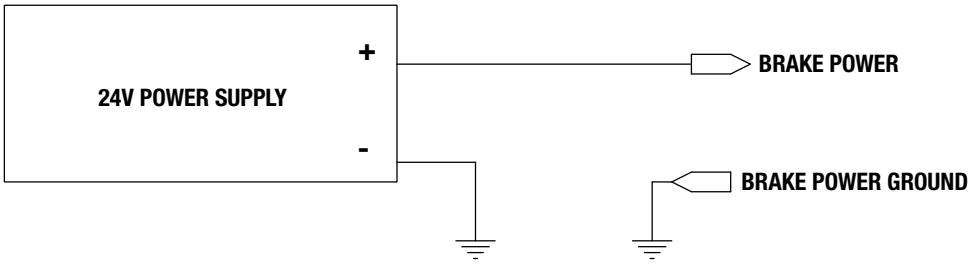


Figure 3-20: ICR/ICM SV1P Plus Optional Electronic Brake Connection

3.7 ICR/ICM Plus Setup

CAUTION!

When cabling multiple actuators, be sure to use the appropriate genders of terminators and cable connectors. The ICR actuator has a female and male communication connector.

The ICR/ICM SV1P Plus actuator can be used as a single-drive setup for optional CANopen position control. It can also be used in a multi-drop RS-232 (RS-232 to optional CANopen) operation or in a multi-drive setup for optional CANopen/ DeviceNet operation. The following illustrations show cabling setup examples of each configuration.

3.7.1 Single Device Setup for optional CANopen Position Control

In a single actuator setup for optional CANopen, the actuator operates as a CAN node. All commands are passed on the CAN bus. The CAN Master must have a CAN address of "0." The actuator CAN address can be any number between 1 and 127. Before installing the actuator as a CAN node, use the CME 2® software for setup and configuration. The software is furnished on the CD shipped with the Tolomatic ICR actuator. You may also download CME 2® software from the Tolomatic web site at www.tolomatic.com/resources. Make these selections from the drop down menus; Product Line: *Electric Linear Motion*; Resource Type: *Software*.

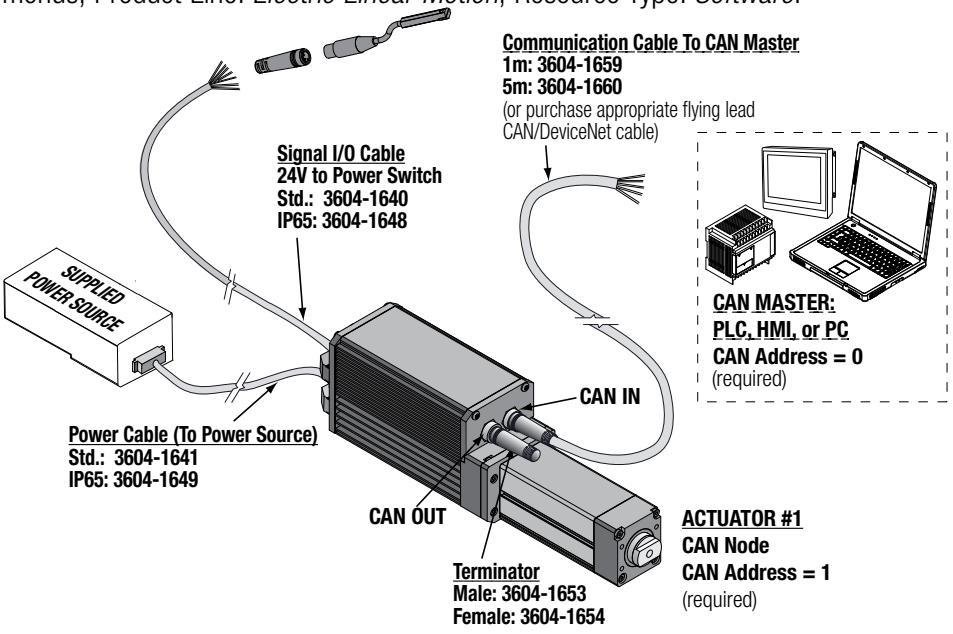


Figure 3-21: ICR/ICM SV1P Plus Single Actuator Setup for optional CANopen Position Control

3.7.2 Multi-drop RS-232 (RS-232 to optional CANopen) Setup

The RS-232 specification does not support multi-drop (multiple device) connections as does RS-485 or CAN. However, it is possible to address multiple CAN-enabled ICR Plus actuators from a single RS-232 port. First, an RS-232 connection is made between a computer and actuator #1 which must have the CAN address of "0". Normally this address is not allowed for CAN nodes but in this case, a ctuator #1

will act as a CAN Master allowing the address. Next, CAN connections are made between actuator #1, actuator #2, and so on in daisy-chain fashion until the last actuator is addressed. The last and first actuator must have the 120 Ohm resistor between the “CAN_H” and “CAN_L” signals to act as a line-terminator. Then, the CAN addresses of the actuators downstream from actuator #1 are set to unique numbers, other than “0”.

When ASCII data is exchanged over the serial port, the commands are now preceded with the node address of the actuator. Actuator #1 converts the data into CAN data which is then sent to all of the actuators in the chain. All actuators in the chain appear to be connected to a single RS-232 port in the computer, hence the reference to multi-drop RS-232.

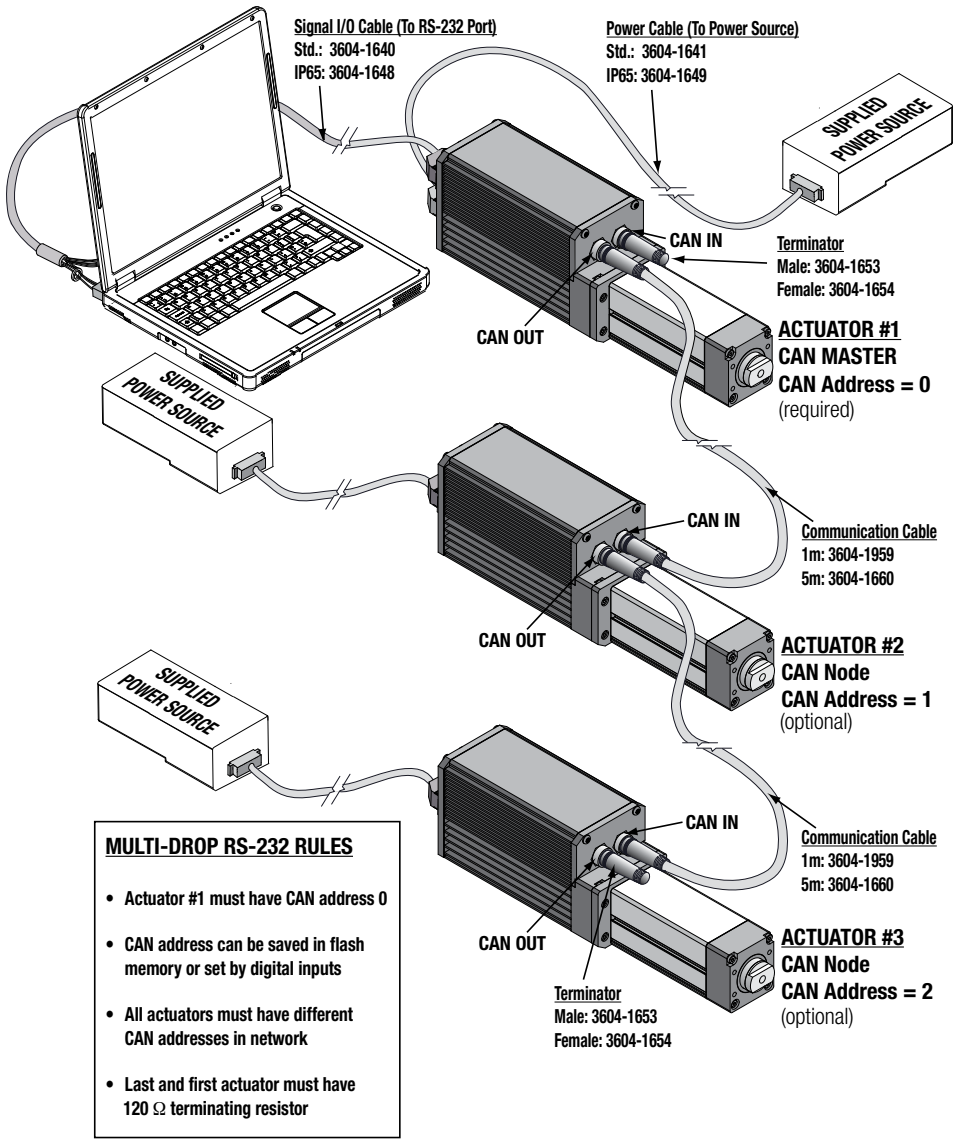


Figure 3-22: ICR/ICM SV1P Plus Multi-drop RS-232 Setup (RS-232 to optional CANopen)

3.7.3 Multiple Device Setup for optional CANopen and DeviceNet

This multiple actuator setup configuration is cabled similar to the Multi-drop RS-232 setup with the addition of a CAN IN cable from actuator #1 routed to a CAN Master device such as a HMI, PLC or PC.

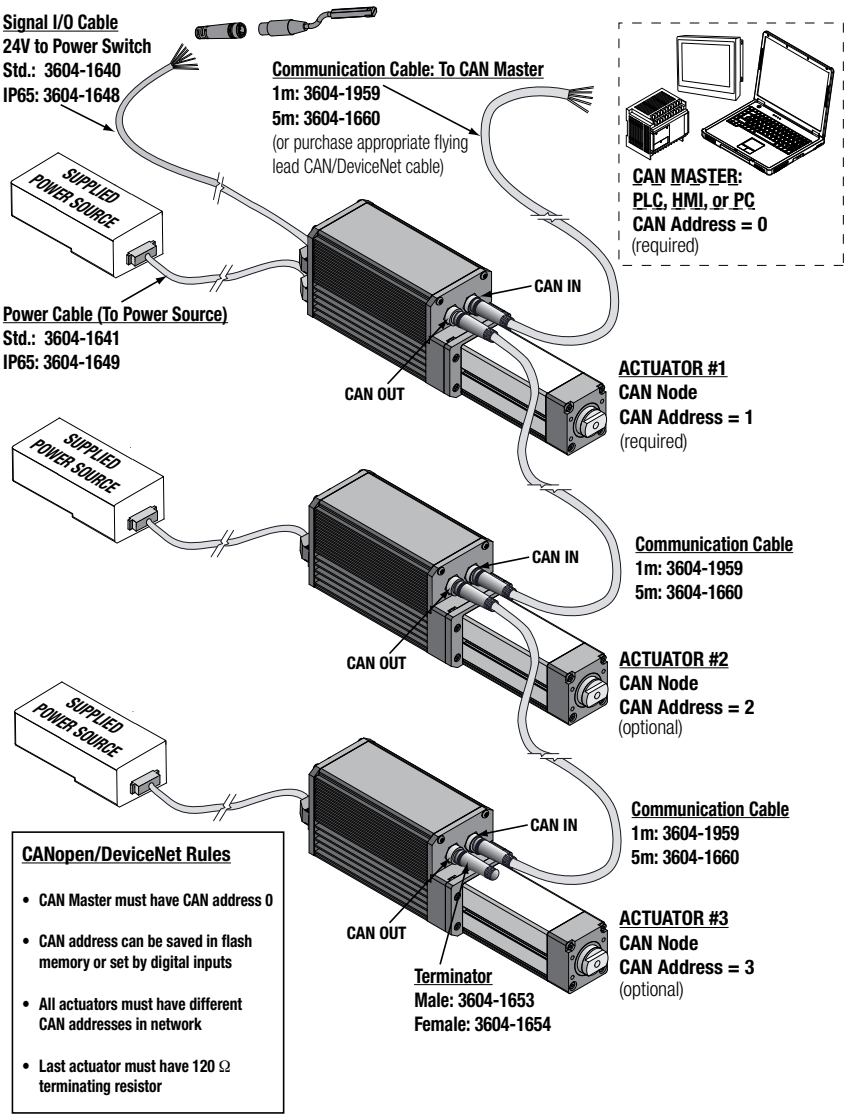


Figure 3-23: ICR/ICM SV1P Plus Multiple Actuator Setup for optional CANopen/DeviceNet Operation

3.8 Environmental Conditions

ICR/ICM SV1P Plus Operating Environment	
Ambient Temperature	77˚ F, 25˚ C Nominal
Operating Temperature	50-122˚ F, 10-50˚ C [de-rate performance above 77˚ F (25˚ C)]
Storage Temperature	50-158˚ F, 10-70˚ C
Humidity	0-95% non-condensing
IP Rating	40 standard, 65 optional

4.1 Regulated and Unregulated Power Supplies

WARNING!

All installations should provide a means for a hardware emergency stop that removes power from the actuator in an emergency condition. The actuator emergency stop function should not be relied on when safety is required. It is recommended to disconnect only the + bus power and keep the power ground line connected.

Both unregulated and regulated power supplies can be used to power the ICR actuator. Unregulated supplies can be a better choice depending on the application as they have a larger output capacitance, which makes them better energy absorption sources. They are a good choice for applications that require aggressive acceleration as they can supply peak currents without faulting and will not trip on high voltage. However, unregulated power supplies do not have over voltage protection and care must be taken not to exceed the maximum voltage of the actuator by using a shunt regulator, and proper fusing to prevent excessive loading of the supply.

Regulated supplies can be used, but additional measures may need to be taken. To prevent regenerative energy from reaching the supply, a blocking diode and capacitor, appropriately sized for the application, should be installed. In addition, a shunt regulator may be needed to dissipate excess energy. The shunt regulator available from Tolomatic (see page 4-4) has the appropriate bus capacitance, requiring only the use of a blocking diode.

The ICR SV1B Basic and SV1P Plus actuators are intended to run off of an isolated DC power source. The power supply that is required will depend on the application. A 48V supply will allow the actuator to operate at maximum speed. A 24V supply will result in approximately half the rated velocity. Input current will depend on the actuator power needed in the installation. If operating more than one actuator on the same power supply, add the required power supply rating for each actuator.

4.1.1. Power Supply Sizing Guidelines

Use the following tables to help determine the proper power source voltage for an application or call Tolomatic at 1-800-328-2174 or 763-478-8000 for assistance.

NOTE: Green numbers indicate power supply required in Watts for the given speed and thrust indicated at outside margins.

BN05 - 1:1 RATIO (Required Power - Watts)

SPEED (in/sec)	THRUST (lbf) 50	100	150	200	250	300	350	400	SPEED (mm/sec)
1	51	66	89	118	155	199	251	309	*25*
2	64	91	124	164	212	265	326	394	*51*
3	78	116	160	210	266	329	398	473	*76*
4	94	142	196	255	320	390	465	546	*102*
5	111	170	233	300	372	448	528	613	*127*
6	130	198	270	345	422	503	587		*152*
7	150	228	308	389	472	556			*178*
8	171	259	346	433	519				*203*
9	194	290	384	476					*229*
9.5	206	306	404						*241*
	222	*445*	*667*	*890*	*1112*	*1334*	*1557*	*1779*	
	THRUST (N)								SPEED (mm/sec)

BN02 - 1:1 RATIO (Required Power - Watts)

SPEED (in/sec)	THRUST (lbf) 20	40	60	80	100	120	140	150	SPEED (mm/sec)
2	26	47	70	95	123	154	186	204	*51*
4	36	66	98	132	169	208	249	271	*102*
6	48	86	127	170	216	263	313	339	*152*
8	61	109	158	210	264	319	377	406	*203*
10	77	133	191	251	313	376	441	475	*254*
12	94	159	226	294	363	434	506	543	*305*
14	113	187	262	338	415	493	572	612	*356*
16	134	217	300	383	468	552	638	681	*406*
18	157	248	339	430	522	613			*457*
20	182	281	380	479	577				*508*
22	209	316	423	528					*559*
24	237	353	467						*610*
	89	*178*	*267*	*356*	*445*	*534*	*623*	*667*	
	THRUST (N)								SPEED (mm/sec)

BN05 - 2:1 RATIO (Required Power - Watts)

SPEED (in/sec)	THRUST (lbf) 100	200	300	400	500	600	700	800	SPEED (mm/sec)
0.5	53	70	93	124	163	209	263	324	*13*
1.0	67	95	130	173	222	279	343	413	*25*
1.5	82	122	168	220	280	345	418	496	*38*
2.0	99	150	206	268	336	409	488	573	*51*
2.5	117	178	244	315	390	470	555	644	*64*
3.0	137	208	283	362	443	528	616	708	*76*
3.5	158	239	323	408	495	584			*89*
4.0	180	271	363	454					*102*
4.5	204	305	403	500					*114*
4.75	216	322	424						*121*
	445	*890*	*1334*	*1779*	*2224*	*2669*	*3114*	*3559*	
	THRUST (N)								

BN02 - 2:1 RATIO (Required Power - Watts)

SPEED (in/sec)	THRUST (lbf) 40	80	120	160	200	240	280	300	SPEED (mm/sec)
1	28	49	73	100	129	161	196	214	*25*
2	38	69	103	139	177	218	262	285	*51*
3	50	91	134	179	226	276	329	356	*76*
4	64	114	166	221	277	335	396	427	*102*
5	81	140	201	264	329	395	464	498	*127*
6	99	167	237	309	381	456	532	570	*152*
7	119	196	275	355	436	517	600	642	*178*
8	141	228	315	403	491	580	670		*203*
9	165	261	356	452	548				*229*
10	191	295	399						*254*
11	219	332	444						*279*
12	249								*305*
	178	*356*	*534*	*712*	*890*	*1068*	*1246*	*1334*	
	THRUST (N)								

ICM (Required Power - Watts)

SPEED (RPM)	TORQUE (in-lb) 2	4	6	8	10	12	14	16
200	28	44	65	91	121	156	196	240
400	38	60	87	119	155	197	243	293
600	48	76	109	147	190	238	290	347
800	59	93	132	176	225	279	338	402
1000	70	110	154	205	260	321	387	458
1200	81	127	177	234	295	363	435	514
1400	93	144	200	263	331	405	485	571
1600	105	161	224	292	367	448	535	628
1800	117	179	247	322	403	491	585	686
2000	129	197	271	352	440	535	636	745
2200	142	215	295	382	477	579		
2400	155	233	319	413	514			
2600	168	252	344	444				
2800	182	271	369					
	0.23	*0.45*	*0.68*	*0.90*	*1.13*	*1.36*	*1.58*	*1.81*
	TORQUE (N-m)							

4.1.2 System Power Overloading Considerations

For applications with large load requirements, care should be taken to prevent the system from generating adverse amounts of power, resulting in overloading and possible failure of the actuator.

Speeds and loads that exceed the amounts indicated in the graph will require a means to control regen energy.

Use the shunt regulator (Part No. 2180-1163) for preventing over voltage conditions. Screw terminals are marked with "+" and "-" and should be connected to the regulated bus (see page 4-4).

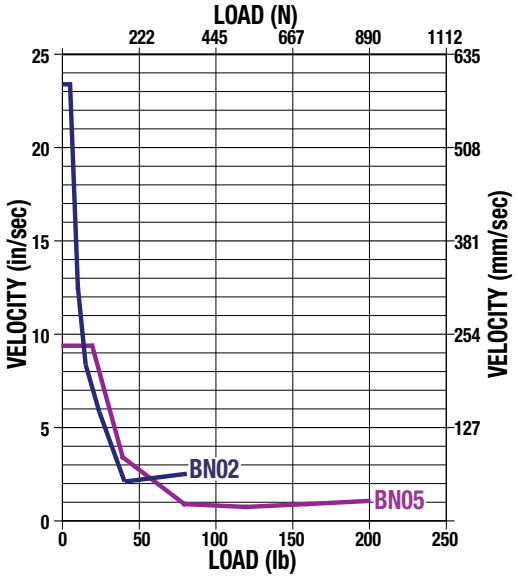


Figure 4-1: Maximum Load/Velocity of System without a Voltage Control Device

4.1.3 Suggested Power Supplies:

Switching Power Supply:	Lambda SWS600-48
Unregulated Power Supply:	International Power IP500U36
Bus Fuse:	15 Amp, 125V or equivalent or sized for application
Logic Power Fuse:	2 Amp, 125V or equivalent

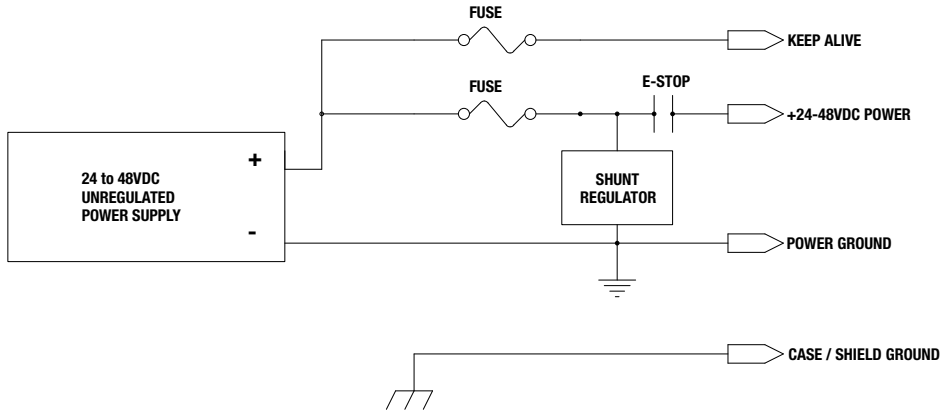


Figure 4-2: Unregulated Power Supply Configuration with Shunt Regulator

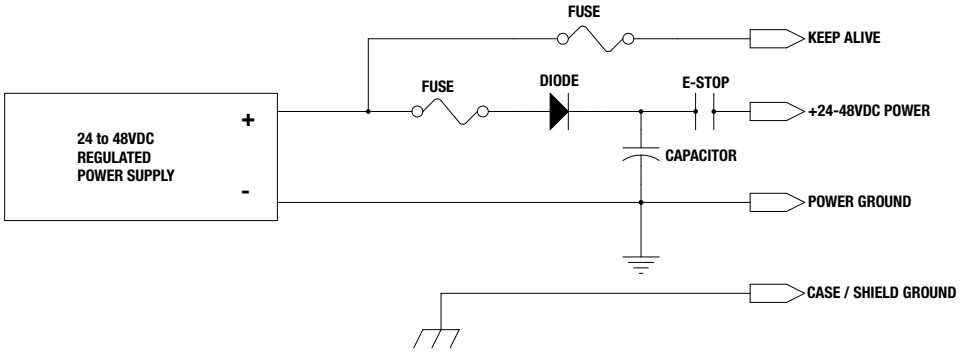


Figure 4-3: Regulated Power Supply Configuration with Blocking Diode and Added Capacitance

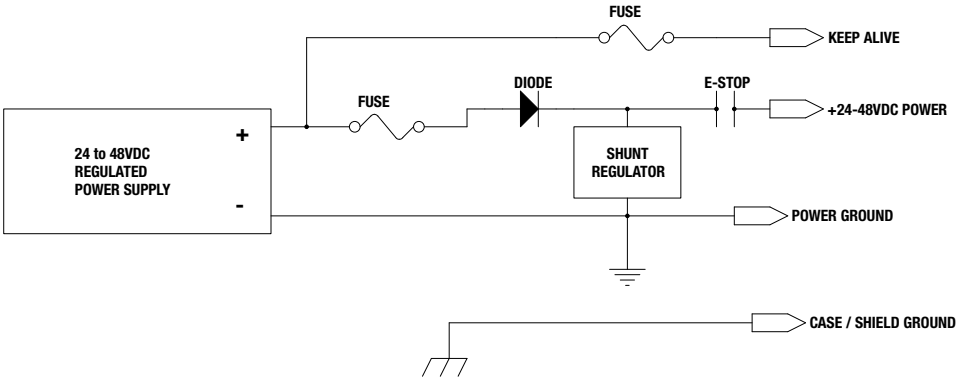


Figure 4-4: Regulated Power Supply with Blocking Diode and Shunt Regulator

WARNING!

Do not reverse polarity of the power input.

CAUTION!

The resistor and the heat plate can become hot during operation.

CAUTION!

Do not apply continuous voltage over the trip voltage to the regulator as this will cause excessive heating.

4.1.4 Shunt Regulators

Shunt regulators work with the ICR Plus and Basic actuators to prevent over voltage conditions. The shunt regulator has screw terminals marked with "+" and "-", which should be connected to the regulated bus.

Shunt Regulator Specifications (2180-1163)	
Voltage Range	24 - 80 VDC
Shunt Resistance	50 Ohms
Continuous Power Dissipation[1]	50 Watts
Peak Power Dissipation[2]	800 Watts

[1] Continuous power dissipation will vary based on installation and ambient conditions.

[2] Power at nominal trip voltage.

If additional power dissipation is needed, additional regulators may be paralleled.

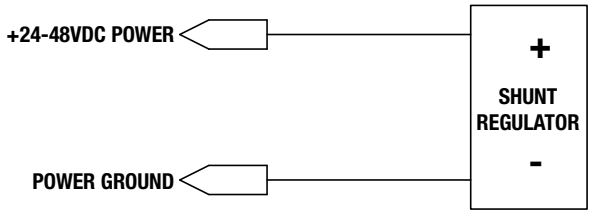


Figure 4-5: Shunt Regulator Input Wiring Diagram

4.1.5 Diodes

A diode with a minimum blocking voltage of 50V is suggested, with a forward current rating of 1.5X peak current rating of the application.

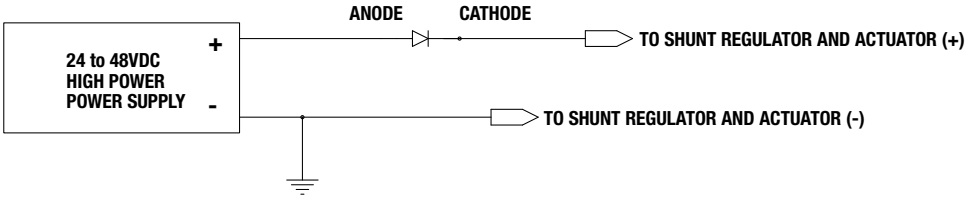


Figure 4-6: Diode Wiring Diagram

5.1 Enable Input Command

The *Enable* input command allows the user to enable and disable the internal drive mechanism with a digital signal. In the *Enabled* state, the actuator will hold its current position without back-driving. When the *Enable* input command is de-activated, the actuator is free to back-drive unless an electronic brake option is installed. Using this option when the *Enable* input command is de-activated signals the drive to apply the brake to the actuator, holding its position before the actuator is disabled. Enable must be maintained for all motion.

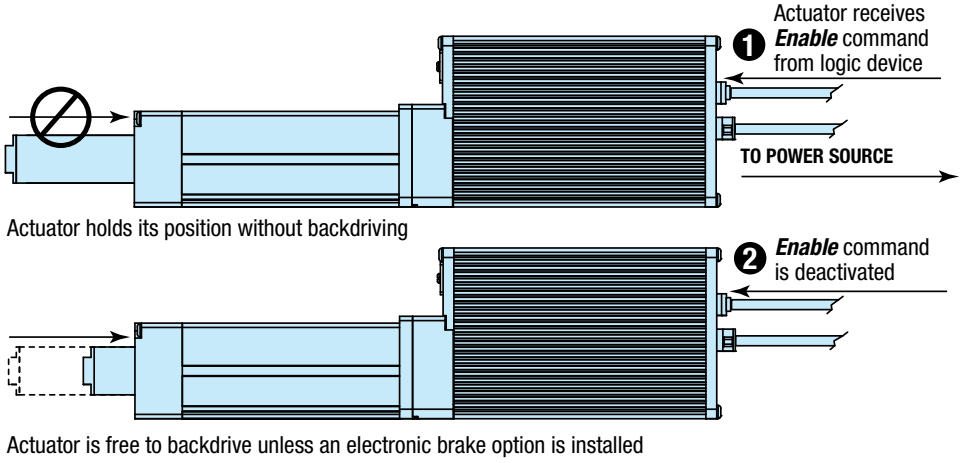


Figure 5-1: ICR SV1B Basic Actuator* Enable *Input Command

5.2 Home Position

CAUTION!

Make sure actuator is free to move for homing so a false home is not detected.

The home position is the retract hard-stop plus a small offset *[BN02 = .022" (.56mm); BN05 = .009" (.23mm)]* away from the hard-stop. The actuator will home when the first input command (Extend or Retract) is given to the actuator after initial power-up.

Velocity and Acceleration Homing Sequence Hard Codes	
VELOCITY	**ACCELERATION**
2 turn per inch ball screw: 3.333 in/sec	2 turn per inch ball screw: 55.5 in/sec^2
5 turn per inch ball screw: 1.333 in/sec	5 turn per inch ball screw: 22.2 in/sec^2

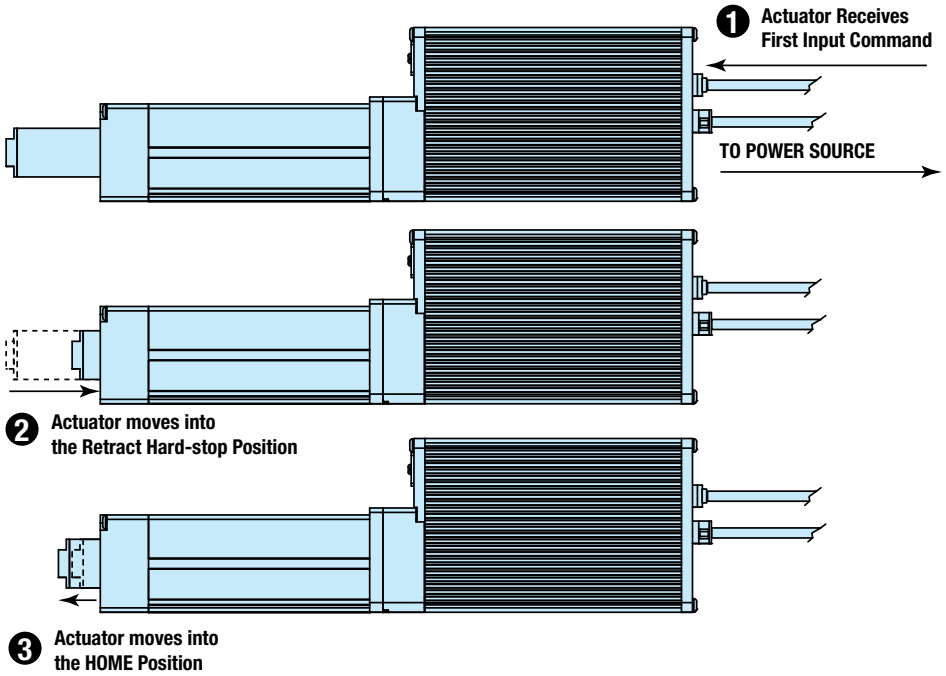
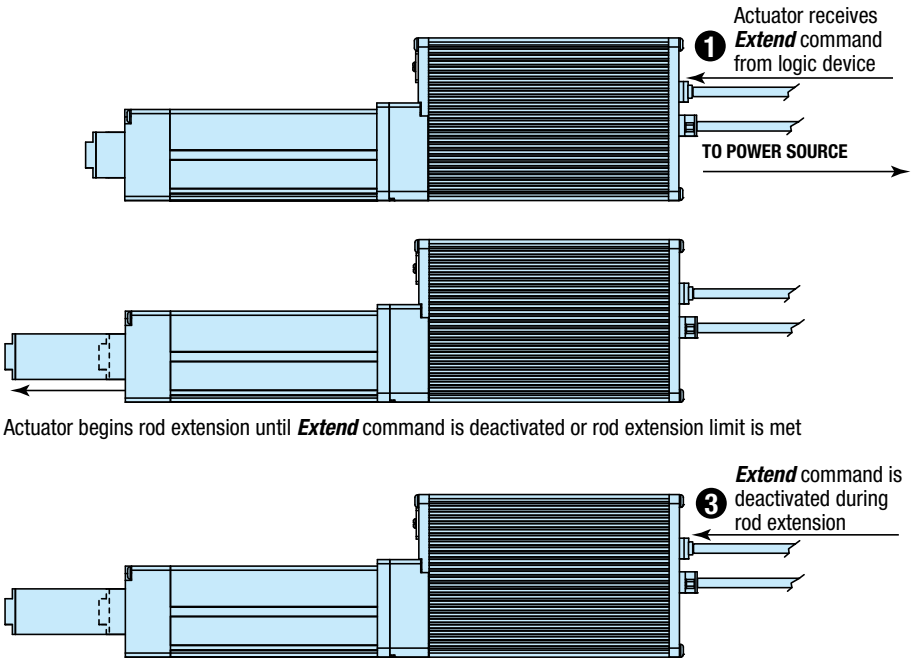

1 Actuator Receives First Input Command
TO POWER SOURCE
2 Actuator moves into the Retract Hard-stop Position
3 Actuator moves into the HOME Position

Figure 5-2: ICR SV1B Basic Actuator Home Position

5.3 Extend Input Command

The *Extend* input command extends the rod of the actuator and is activated by an external logic device such as a PLC. Rod extension will continue until the *Extend* input command is de-activated or the actuator reaches the rod extend limit set in the firmware. If the *Extend* input command is deactivated during rod extension, the actuator will decelerate to a stop and hold its position. If the *Retract* input command is activated during rod extension, the actuator will decelerate to a stop, hold its position, and activate a *Fault* output signal.

VELOCITY	ACCELERATION
2 turn per inch ball screw: 3.333 in/sec	2 turn per inch ball screw: 55.5 in/sec^2
5 turn per inch ball screw: 1.333 in/sec	5 turn per inch ball screw: 22.2 in/sec^2


Actuator receives
Extend command
from logic device
TO POWER SOURCE
Actuator begins rod extension until Extend command is deactivated or rod extension limit is met
Extend command is
deactivated during
rod extension
Actuator decelerates to stop and holds position

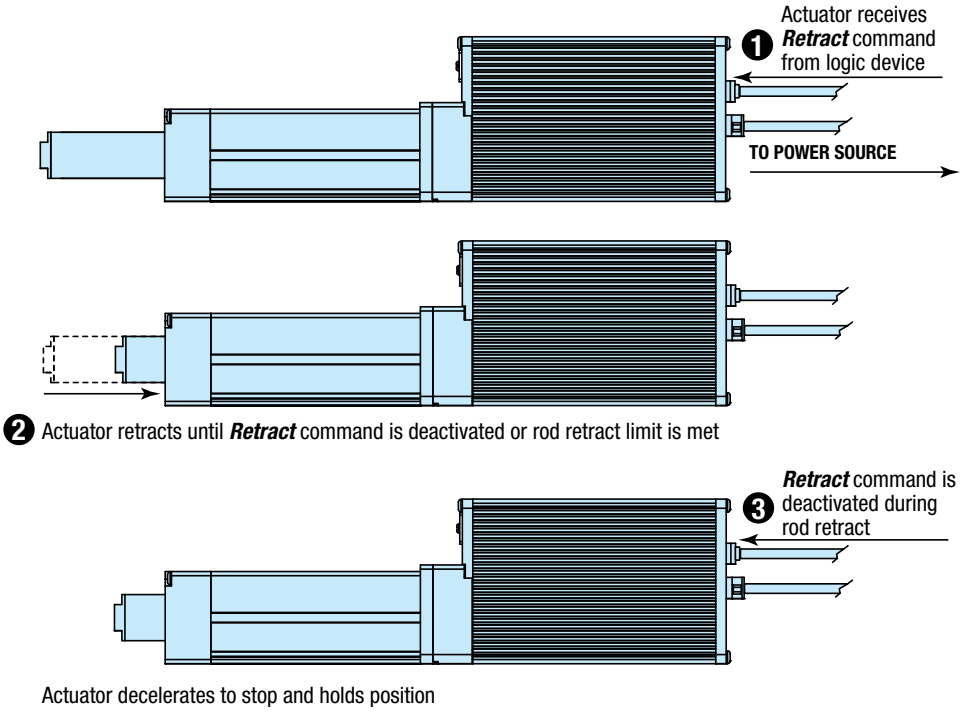
Activating a ***Retract*** input command during rod extension will bring the actuator to a stop, hold its position and activate a ***Fault*** output signal.

Figure 5-3: ICR SV1B Basic Actuator* Extend *Input Command

5.4 Retract Input Command

The *Retract* input command retracts the rod of the actuator and is activated by an external logic device such as a PLC. The rod will retract until the *Retract* input command is deactivated or the actuator reaches the rod retract limit set in the firmware. If the *Retract* input command is deactivated during rod retract, the actuator will decelerate to a stop and hold its position. If the *Extend* input command is activated during rod retract, the actuator will decelerate to a stop, hold its position, and activate a *Fault* output signal.

VELOCITY	ACCELERATION
2 turn per inch ball screw: 3.333 in/sec	2 turn per inch ball screw: 55.5 in/sec^2
5 turn per inch ball screw: 1.333 in/sec	5 turn per inch ball screw: 22.2 in/sec^2


Actuator receives
1 Retract command
from logic device
TO POWER SOURCE
2 Actuator retracts until Retract command is deactivated or rod retract limit is met
3 Retract command is
deactivated during
rod retract
Actuator decelerates to stop and holds position

Activating an ***Extend*** input command during rod retract will bring the actuator to a stop, hold its position and activate a ***Fault*** output signal.

Figure 5-4: ICR SV1B Basic Actuator* Retract *Input Command

5.5 E-stop Input

CAUTION:

The* E-Stop *input is NOT a fail safe input.

The *E-Stop* input allows the user to disable the actuator for safety reasons. This is NOT a fail safe input. Until the *E-Stop* input is cleared, the actuator cannot be enabled or move in either the extend or retract mode. When the *E-Stop* input is active, the *Fault* output is automatically activated.

5.6 Fault Output

The *Fault* output is a status output for the logic device indicating that a fault has occurred in the actuator. Valid faults are for e-stop, following error, over/under voltage, current limit and over temperature (PCB and motor).

5.7 In-Position Output

The *In-Position* output is a status output to the logic device indicating when the actuator is in position. When a motion begins, the *In-Position* output is turned off. When the motion is complete, the *In-Position* output is turned on.

ICR SV1B Basic Actuator In-Position Window Definitions	
SCREW DESCRIPTION	**IN-POSITION WINDOW**
2 turn per inch ball screw	.0125” (.317 mm)
5 turn per inch ball screw	.005” (.127 mm)

5.8 User Interface

There is no software or graphical user interface (GUI) for the ICR SV1B Basic actuator. Instead, there are three potentiometers located on the top face of the actuator. Controls are limited to *Extend* velocity, *Retract* velocity and *Force* control. Potentiometer adjustments can be made easily and simply by the use of a small screwdriver.

CAUTION:

Do NOT overturn potentiometers

Each potentiometer has a 270° range of motion. Exceeding the mechanical limits of the potentiometer will result in permanent damage!

Figure 5-5: ICR SV1B Basic Actuator Velocity and Force Controls

5.8.1 Extend Velocity Potentiometer

The *Extend* velocity potentiometer is used to set the *Extend* velocity of the actuator's rod. The velocity range is stated from 2-100% of maximum velocity. Changes made to the *Extend* velocity potentiometer setting will only take effect after the actuator is stopped and before the next motion is commanded. Turn the potentiometer screw clockwise to increase the actuator's rod *Extend* velocity and counter-clockwise to decrease the *Extend* velocity.

Figure 5-6: ICR SV1B Basic Actuator* Extend *Velocity Potentiometer

5.8.2 Retract Velocity Potentiometer

The *Retract* velocity potentiometer is used to set the *Retract* velocity of the actuator's rod. The velocity range is stated from 2-100% of maximum velocity. Changes made to the *Retract* velocity potentiometer setting will only take effect after the actuator is stopped and before the next motion is commanded. Turn the potentiometer screw clockwise to increase the actuator's rod *Retract* velocity and counter-clockwise to decrease the *Retract* velocity.

Figure 5-7: ICR SV1B Basic Actuator* Retract *Velocity Potentiometer

5.8.3 Force Control Potentiometer

The *Force* control potentiometer is used to set the actuator's force limit allowing it to stop and hold (also known as push and hold) in position. The potentiometer setting must be between 10-100% of the actuator's capable *Force* output for the setting to be activated. Settings of less than 10% disable the *Force* control feature. For example, when the actuator makes contact and starts to build up force, it keeps building force to threshold levels. At that point, the actuator stops and holds its position.

Push force for locating is best used under low velocity *[less than 3"/sec. (76mm/sec.) recommended]* conditions to give the actuator time to react.

Figure 5-8: ICR SV1B Basic Actuator* Force *Control Potentiometer

5.9 User Interface *(SV1B Manufactured before 4-2013)*

There is no software or graphical user interface (GUI) for the ICR SV1B Basic actuator. Instead, there are three potentiometers located on the front face of the actuator. Controls are limited to *Extend* velocity, *Retract* velocity and *Force* control. Potentiometer adjustments can be made easily and simply by the use of a small screwdriver.

CAUTION:

Do NOT overturn potentiometers

Each potentiometer has a 240° range of motion. Exceeding the mechanical limits of the potentiometer will result in permanent damage!

Figure 5-9: ICR SV1B Basic Actuator Velocity and Force Controls

5.9.1 Extend Velocity Potentiometer *(SV1B Manufactured before 4-2013)*

The *Extend* velocity potentiometer is used to set the *Extend* velocity of the actuator's rod. The velocity range is stated from 2-100% of maximum velocity. Changes made to the *Extend* velocity potentiometer setting will only take effect after the actuator is stopped and before the next motion is commanded. Turn the potentiometer screw clockwise to increase the actuator's rod *Extend* velocity and counter-clockwise to decrease the *Extend* velocity.

Figure 5-10: ICR SV1B Basic Actuator* Extend *Velocity Potentiometer

5.9.2 Retract Velocity Potentiometer
(SV1B Manufactured before 4-2013)

The *Retract* velocity potentiometer is used to set the *Retract* velocity of the actuator's rod. The velocity range is stated from 2-100% of maximum velocity. Changes made to the *Retract* velocity potentiometer setting will only take effect after the actuator is stopped and before the next motion is commanded. Turn the potentiometer screw clockwise to increase the actuator's rod *Retract* velocity and counter-clockwise to decrease the *Retract* velocity.

Figure 5-11: ICR SV1B Basic Actuator* Retract *Velocity Potentiometer

5.9.3 Force Control Potentiometer
(SV1B Manufactured before 4-2013)

The *Force* control potentiometer is used to set the actuator's force limit allowing it to stop and hold (also known as push and hold) in position. The potentiometer setting must be between 10-100% of the actuator's capable *Force* output for the setting to be activated. Settings of less than 10% disable the *Force* control feature. For example, when the actuator makes contact and starts to build up force, it keeps building force to threshold levels. At that point, the actuator stops and holds its position.

Push force for locating is best used under low velocity *[less than 3"/sec. (76mm/sec.) recommended]* conditions to give the actuator time to react.

Figure 5-12: ICR SV1B Basic Actuator* Force *Control Potentiometer

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The Tolomatic ICR/ICM SV1P Plus actuator incorporates Copley Controls Corporation drive and control components and utilizes their software to communicate to logic devices. References to software programs and manuals are provided where applicable and are on the Tolomatic CD-ROM that shipped with the actuator. The manuals and software are also available online. Web addresses are provided where appropriate throughout this section.

6.1 Host Computer Requirements

The ICR/ICM SV1P Plus actuator is designed to be used with a host computer, PLC or HMI device along with a power supply (see Section 4: Power Supply Recommendations). Before installing the communication software, be sure the supplied devices have the minimal host requirements indicated below.

6.1.1 Hardware Requirements

CPU: 400 Mhz

RAM: 128 MB

6.1.2 Operating Systems Supported

Windows®NT, 2000, XP, Vista

Notes for Windows® Vista users:

Windows® Vista is supported in the CME 2® Software supplied on the Tolomatic CD-ROM shipped with the actuator.

On Installation in Windows® Vista: When the installer starts, a message will be displayed stating that an unidentified program is trying to access the computer. Click the button to allow the installer to continue, and CME 2® will be installed properly.

Program File Storage in Windows® Vista: Other Windows® operating systems store user data for CME 2® (ccx, ccm, files, etc.) in C:\Program Files\Copley Motion\CME 2. Due to Windows® Vista security, user data is stored in C:\Users\Public\Public Documents\Copley Motion\CME 2®.

6.1.3 Software Requirements

Copley Controls CME 2® (Copley Motion Explorer) software, Version 5.1 or higher.

6.2 Install the CME 2® Software

The CME 2® software is available on the Tolomatic CD-ROM that shipped with the ICR Plus actuator. It is also available on the Tolomatic web site.

TOLOMATIC SOFTWARE CHANGE HISTORY		
Date	**Firmware**	**CME 2 Software**
Release	1.90	5.3
11/10/2011	3.12	6.0
2/21/2013	3.26	6.0

6.2.1 Web Download Install

1. Choose or create a folder location to download the software installation file.
2. Navigate to http://www.tolomatic.com/resources/index.cfm.
3. Make these selections; Click on product line: *Electric Linear Motion*; then click on resource tab: *Software*.
4. Choose the *ICR Plus SmartActuator Setup Software v6.0* link.
5. Click and save the *Installer.zip* file to the selected folder.
6. Extract the contents of the .zip file to the same location. The folder should contain the *Setup.exe* file. Run the setup.exe file.

6.2.2 CD-ROM Install

1. Insert the Tolomatic CD-ROM supplied with the ICR Plus actuator. Inserting the CD will cause the installation script to launch and a CME 2® installation screen appears. If not, navigate to the root directory and double-click on the *Setup.exe* file.
2. Respond to the prompts on the CME 2® installation screens to complete the installation. It is recommended to accept all the default installation values.

If using Windows® Vista, reference the installation notes on page 6-1.

6.3 Start the CME 2® Software

6.3.1 Initial Communication Setup

1. Double-click the CME 2® shortcut icon on the Windows® desktop to start the program.

Figure 6-1: Copley Motion Explorer CME 2® Shortcut Icon

2. For initial communication set up, the Communications Wizard will prompt a device selection of either *Serial Ports* or *CAN Network*.

Figure 6-2: Communication Wizard Device Selection Screen

3. *Serial Ports* should be selected for RS-232 or DeviceNet control. For these selections, proceed to 6.4: Configure Serial Port Parameters. If *CAN Network* is selected, proceed to 6.5: Configure CAN Network Parameters.

6.4 Configure Serial Port Parameters (RS-232 and DeviceNet)

One or more serial ports on a PC can be used to connect amplifiers. Use the following instructions to add ports for amplifiers, choose baud rates for the ports, and remove ports for amplifiers.

This procedure is also used if the amplifier is to run under DeviceNet control. For more information on DeviceNet setup, refer to the Copley DeviceNet Programmer's Guide located on the CD-ROM that shipped with the ICR/ICM Plus.

1. Select *Serial Port* as the device (see Figure 6-2) in the Communications Wizard (Tools/Communication Wizard) and click the *Next* button to open the *Communications Wizard Select Serial Ports* screen.

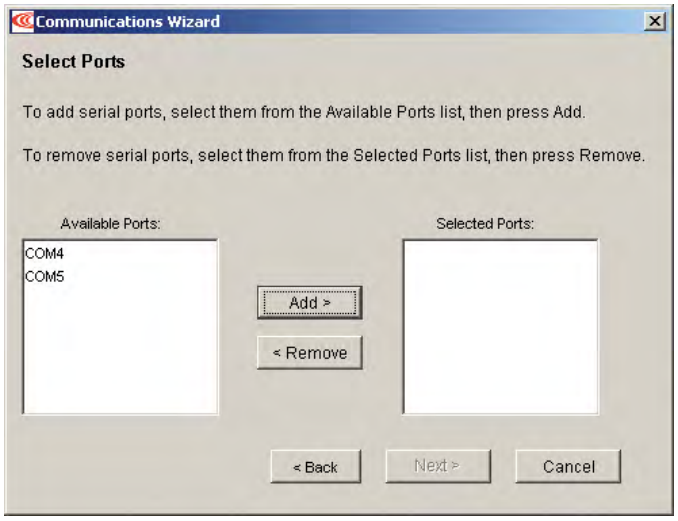


Figure 6-3: Communication Wizard Serial Port Screen

2. To add ports, from the *Available Ports* list, select the serial ports to be used for amplifiers and click *Add*.
3. To remove ports from the *Selected Ports* list, select the serial ports and click *Remove*.
4. Click *Next* to save selections and open the *Communications Wizard Configure Serial Ports* screen.

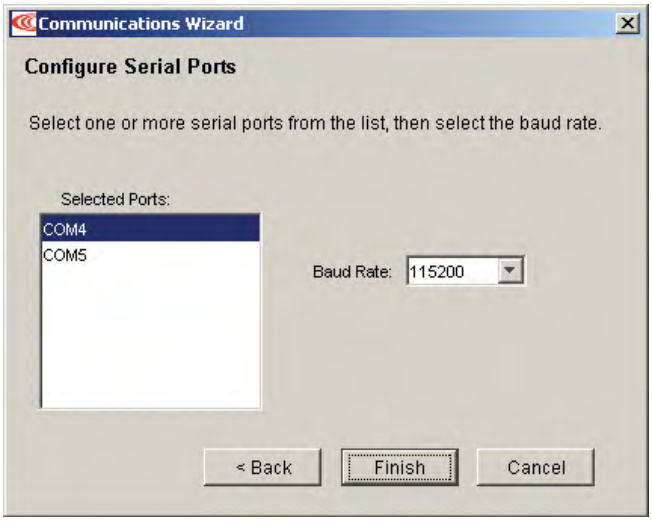


Figure 6-4: Communication Wizard Configure Serial Ports Screen

5. From the *Selected Ports* list, highlight the port desired and select a *Baud Rate*. Repeat for each port selected and click *Finish* to save changes.

6.5 Configure CAN Network Parameters

A CAN port can be used to connect the host PC to one or more amplifiers. Use the following instructions to configure CAN Network settings.

1. In the *Communications Wizard Device Selection* screen select *CAN Network*. Click *Next* to open the *Communications Wizard Configure CAN Network* screen.

Figure 6-5: Communication Wizard Configure CAN Network Screen

2. Select the appropriate *CAN Card*, *Channel*, *Bit Rate*, and click *Finish*.

   The *CAN Card* list shows the manufacturer names of all supported CAN cards that have been connected to the PC and which drivers have been installed.

   All amplifiers must be set to the same bit rate (default is 1 Mbit/s).

6.6 CME 2® User Interface and Tool Bar

The CME 2® User Interface features are illustrated in Figure 6-6 below. Screen details will vary depending on amplifier model and mode selection.

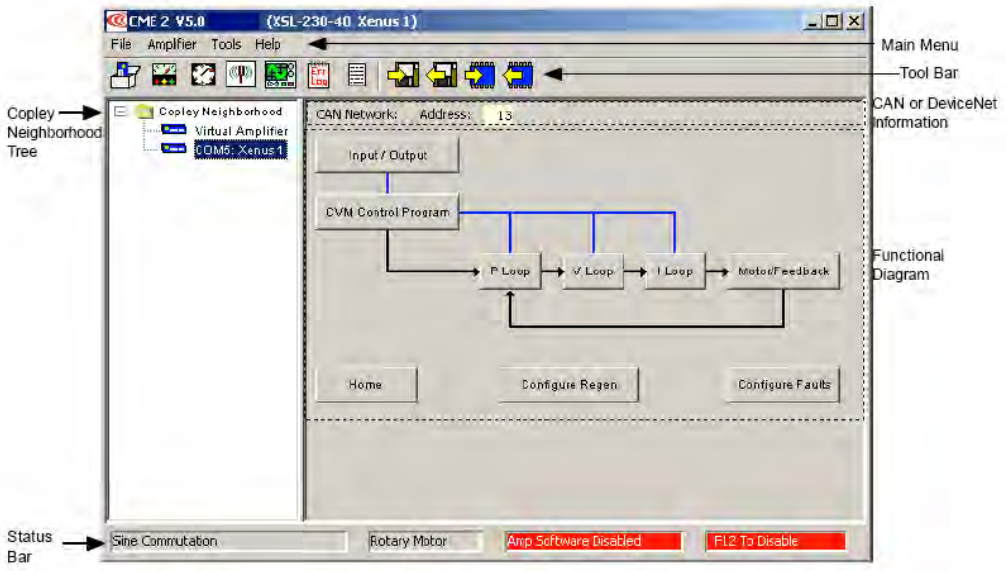


Figure 6-6: CME 2® User Interface Features

The CME 2® Interface Tool Bar contains 11 icons. Their description and functions are explained in the table below.

CME 2® User Interface Tool Bar Icons and Functions		
	Basic Setup Icon	Opens the Basic Setup Screen.
	Control Panel Icon	Opens Control Panel.
	Auto Phase Icon	Not required because the ICR actuator is pre-set at Tolomatic.
	Auto Tune Icon	Not required because the ICR actuator is pre-tuned at Tolomatic.
	Scope Icon	Opens the Scope window.

CME 2® User Interface Tool Bar Icons and Functions (con't)		
	Amplifier Properties Icon	Displays basic amplifier properties.
	Save Amplifier Data to Disk Icon	Saves contents of amplifier RAM to a disk file.
	Restore Amplifier Data From Disk	Restores an amplifier file from disk to amplifier RAM.
	Save Amplifier Data to Flash	Saves contents of amplifier RAM to flash memory.
	Restore Amplifier Data from Flash	Restores contents of flash memory to amplifier RAM.

For complete details on the File, Amplifier, Tools and help menu choices and functional diagram, refer to the CME 2® User Guide furnished on the CD-ROM that shipped with the ICR Plus actuator.

6.7 ICR/ICM SV1P Plus Amplifier Files

6.7.1 Loading the Amplifier Files

The amplifier file (*.ccx) for the ICR/ICM SV1P Plus actuator is configured and loaded by Tolomatic at the factory. The amplifier file contains setup, motor, and tuning information allowing the actuator to operate once it is powered. The default mode of operation is in a position mode via a program. Input 1 is predefined as enable. Input 11 (internal) is the motor temperature switch. Digital output #4 is predefined as the brake output.

If the actuator becomes inoperable for any reason, it can be returned to factory defaults by copying the amplifier data. Follow steps 1 though 5 in the procedure outlined in *CME 2® User Guide, Appendix A: Copy Amplifier Data,* then load the "ICRSVIP.ccx" file provided with the ICR/ICM SV1P Plus.

IN1 = Enable

IN11 = Motor Temp Switch

6.7.2 Saving Amplifier Files

If any changes to setup, motor, or tuning have been made, a new amplifier can be saved to the disk with the following procedure:

Click on the 'Save amplifier data to disk' icon on the tool bar.

Figure 6-7: CME 2® Save Amplifier Data To Disk Icon

6.8 Command Sources

6.8.1 Programmable Command

The Indexer programming environment can be used to develop and execute programs to operate the ICR Plus actuator. To access the Indexer 2 program, click on the *CVM (Copley Virtual Machine) Control Program* button on the CME 2® main screen to open the *Indexer 2 Program and I/O Line States* screens.

The Indexer 2 Program in the amplifier's flash memory will be displayed. The numbers of sequences which have been programmed with steps will be displayed with a green background, as some of the sequences shown below. The *I/O Line States* screen shows real-time status of the amplifier's digital inputs and outputs.

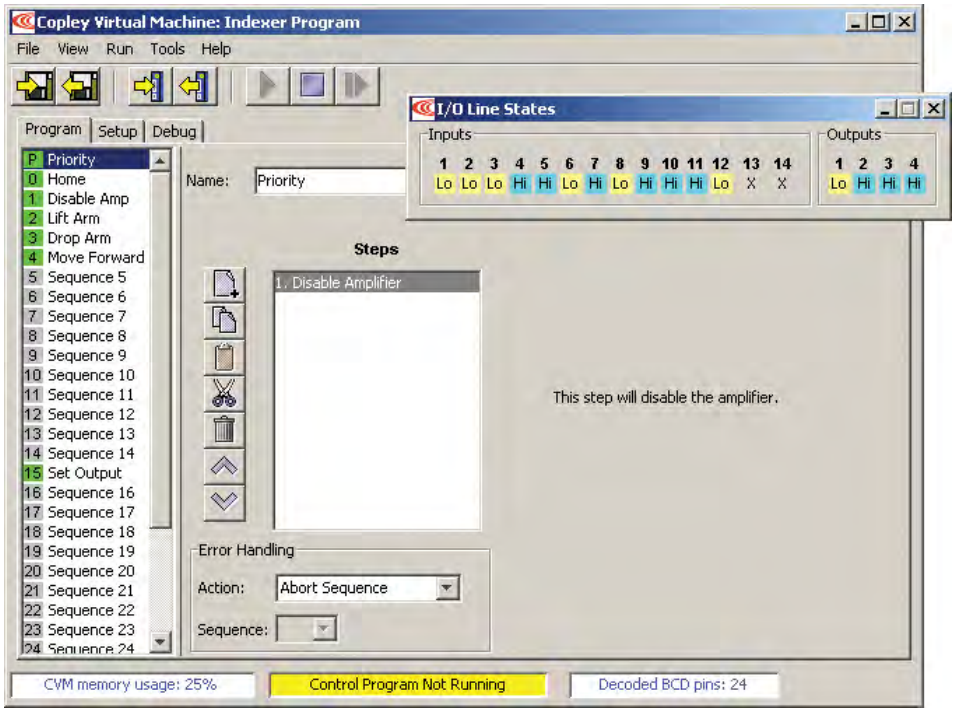


Figure 6-8: CVM Control Program Indexer 2 Program and I/O Line States

For complete information on programming, functions, ASCII commands over serial, homing and loading configurations from files using the indexer program, refer to the Indexer 2 Program User Guide (*Indexer_user_guide.pdf*) on the Tolomatic CD-ROM that shipped with the ICR Plus actuator.

6.8.2 Analog Command

The ICR Plus actuator can be driven by an analog voltage signal through the Analog Command input. The amplifier can convert the signal to a current (torque), velocity or position mode. When using the ICR Plus actuator, select the position operating mode. The encoder on the ICR Plus is not exposed through the connectors and requires a factory modification in order to utilize the current and velocity mode scaling parameters. **Contact Tolomatic if current or velocity modes of operation are required.**

To program the ICR Plus actuator using the analog input as the command source:

1. In the *Basic Setup* screen, navigate to the *Operating Mode Options* screen.
2. Select *Position* for the *Operating Mode*.
3. Select *Analog* for the *Command Source*.

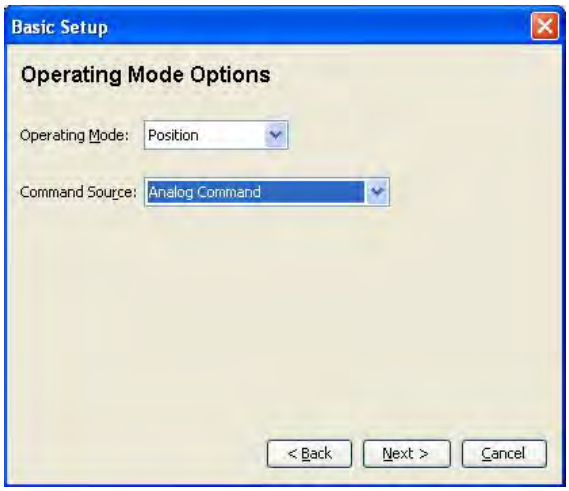


Figure 6-9: CME 2® Basic Setup Operating Mode for Analog Command Source

4. Refer to the *CME 2® User Guide, Section 7.1: Analog Command Settings* supplied on the CD-ROM shipped with the ICR Plus actuator for complete information on using the analog command setting parameters.

6.8.3 Digital Input Command

A digital input can be used to command the actuator in a pulse/direction mode similar to stepper control. This command input is received from a PLC, a motion controller, or other pulse generating device.

To program the ICR Plus actuator using a digital input as the command source:

1. In the *Basic Setup* screen, navigate to the *Operating Mode Options* screen.
2. Select *Position* for the *Operating Mode*.
3. Select *Digital Input* for the *Operating Mode*.

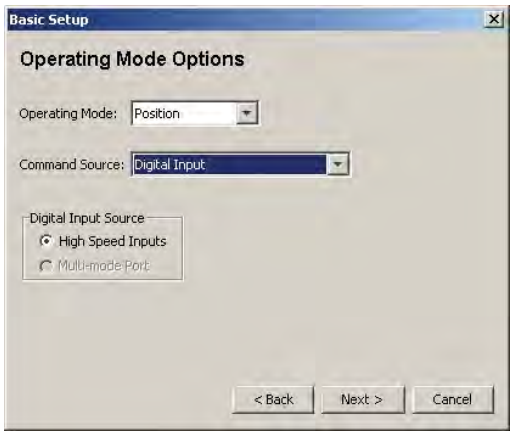


Figure 6-10: CME 2® Basic Setup Operating Mode for Digital Input Command Source

4. Refer to the *CME 2® User Guide, Section 7.3: Digital Position Input Settings* for complete information on using the digital position parameter settings.

6.8.4 Communication Commands

There are three interfaces that can be configured to communicate with the ICR Plus actuator:

1. **ASCII commands over RS-232**

   A serial port can be used to communicate with the ICR Plus actuator using RS-232. This command can be received from a PC, PLC, HMI or other device and can be initiated as a single-axis or multi-drop configuration.

   For illustrations on setting up the ICR Plus actuator using RS-232, refer to pages 3-12 to 3-13. For specifics on the ASCII Command Line Interface, refer to *Appendix G: ASCII Commands/Serial Control* of the *CME2_User_Guide.pdf* provided on the CD-ROM shipped with the ICR Plus actuator. For constructing ASCII strings to send serially, refer to *ASCII_ProgrammersGuide.pdf* contained on the same CD-ROM.

2. **Optional CANopen**

   Optional CANopen can be used to communicate with single or multiple ICR Plus actuators. This command can be received from a PC, PLC, HMI or other device.

   For illustrations on setting up the ICR Plus actuator using optional CANopen, refer to page 3-14. For complete details on CANopen networks, refer to *Section 8: CAN Network Configuration* on the *CME2_User_Guide.pdf* and the *CANopenProgrammersManual.pdf* provided on the CD-ROM shipped with the ICR Plus actuator.

3. **DeviceNet**

   DeviceNet can be used to communicate to single or multiple ICR Plus actuators. This command can be received from a PC, PLC, HMI or other device.

   For illustrations on setting up the ICR Plus actuator using DeviceNet, refer to page 3-14. For complete programming details and instructions, refer to the *DeviceNetProgrammersGuide.pdf* provided on the CD-ROM shipped with the ICR Plus actuator.

6.9 Diagnostics

6.9.1 Control Panel

The Control Panel is used for general status and control of the ICR Plus actuator. Use this diagnostic tool to quickly check faults, monitor position, enable/disable, and initiate simple moves.

To access the Control Panel, click on the *Control Panel* icon in the tool bar.

Figure 6-11: CME 2® Tool Bar - Control Panel Location

Highlighted below are the Control Panel features.

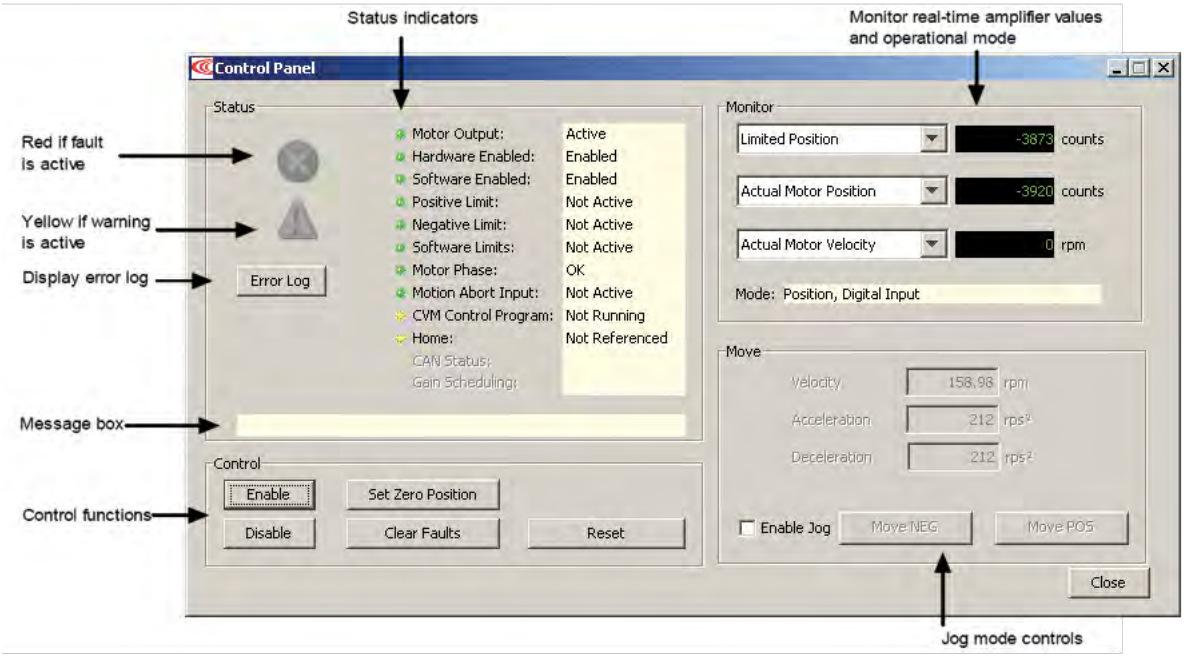


Figure 6-12: CME 2® Control Panel Features

For details on using the Control Panel stats indicators, monitor channels and functions, refer to *Section 14: Control Panel* on the *CME 2® User Guide* provided on the CD-ROM shipped with the ICR Plus actuator.

6.9.2 Scope Tool

The Scope is used for monitoring signals and values in the ICR Plus actuator while testing motion sequences. It can also be used for fine tuning the actuator.

To access the Scope Tool, click on the *Scope Tool* icon located on the CME 2® Tool Bar.

Figure 6-13: CME 2® Tool Bar - Scope Tool Location

Highlighted below are features of the Scope Tool.

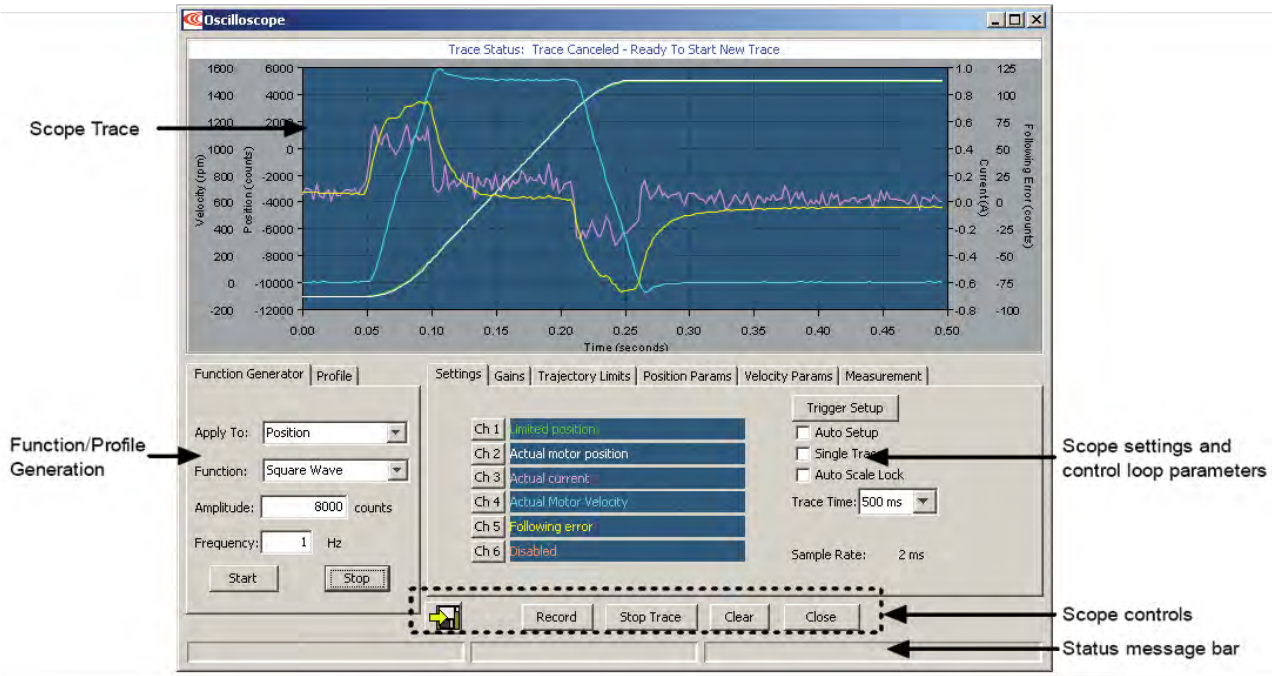
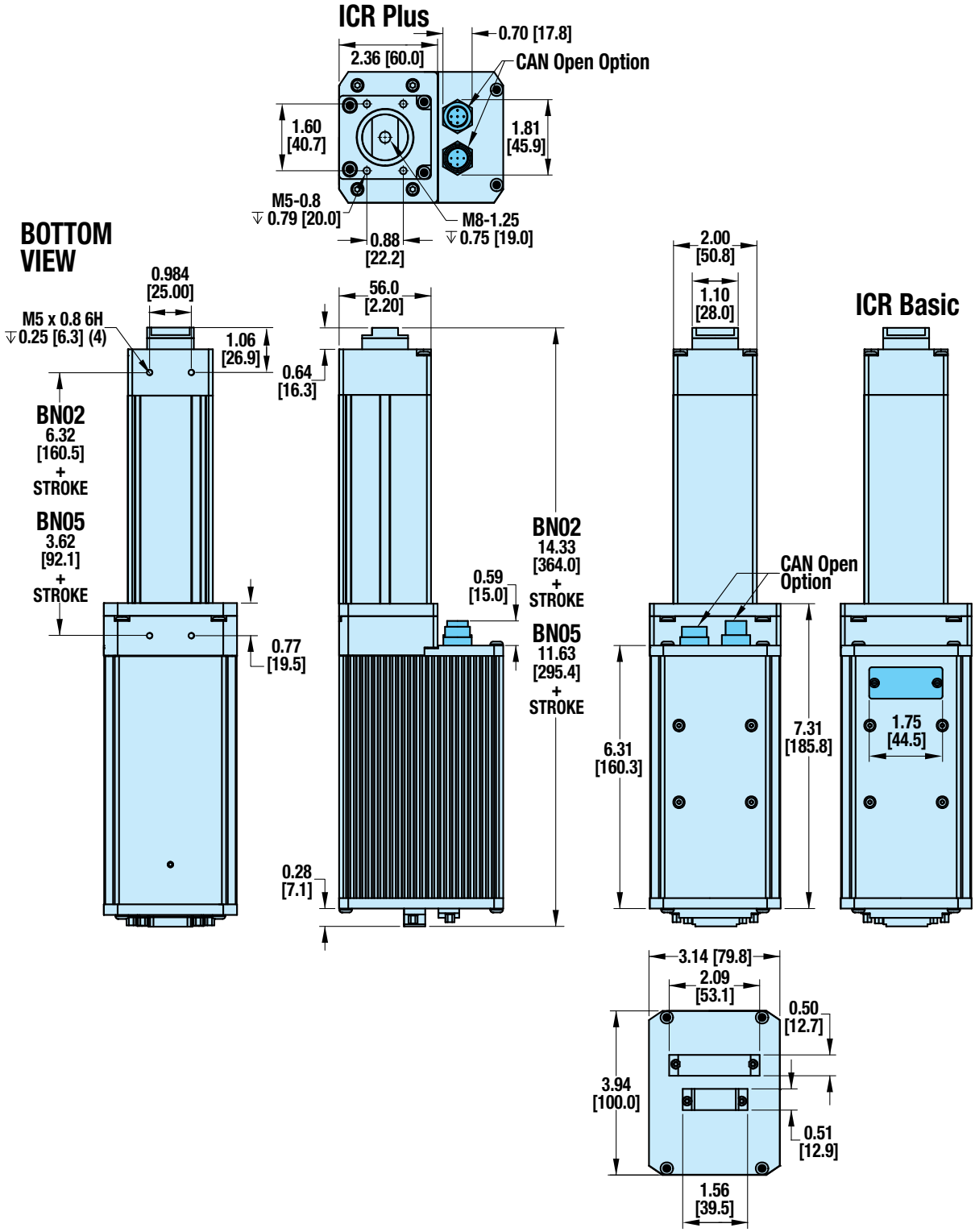


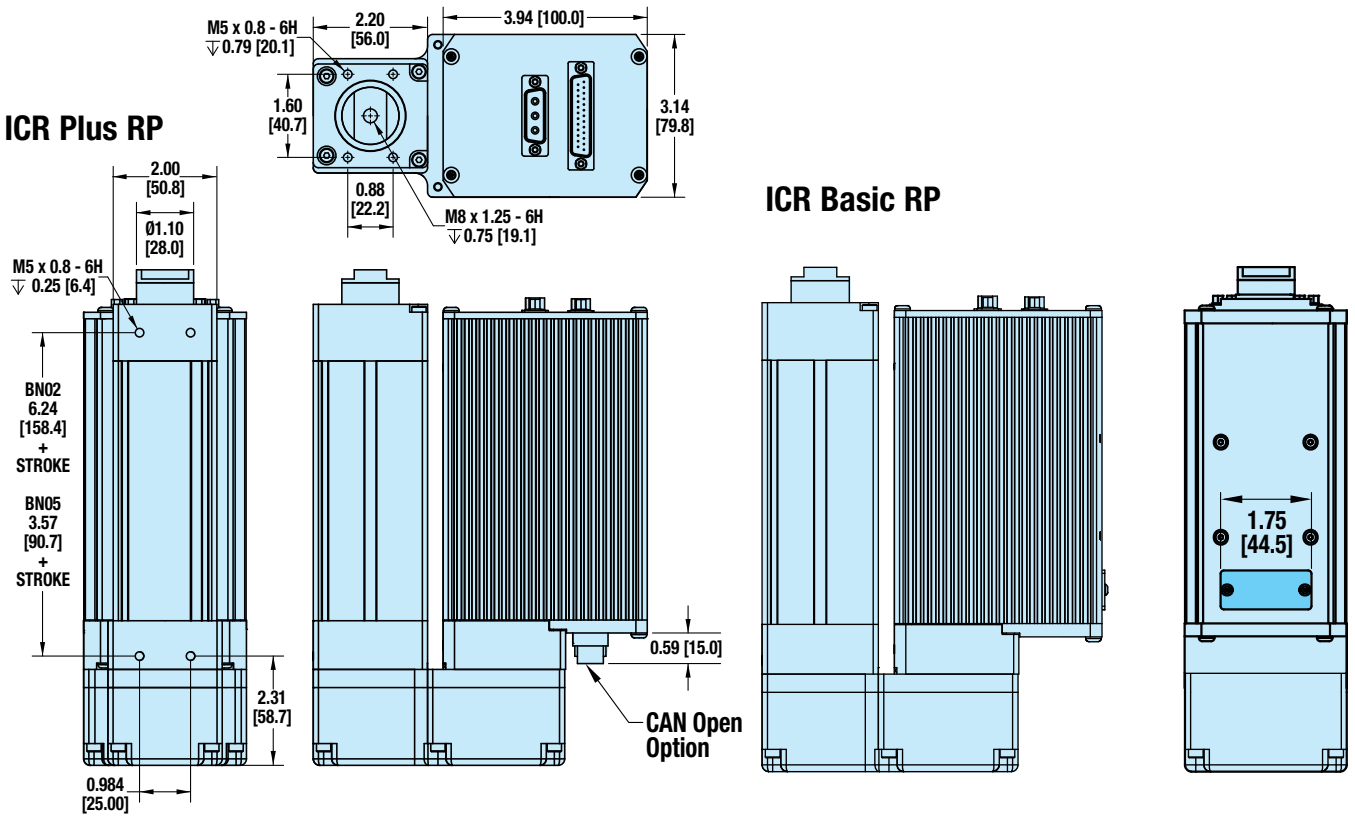
Figure 6-14: CME 2® Scope Tool Screen

For more details on features, function generator and profile tabs, trace channels, trigger setup, display and control loop parameters, refer to *Section 15: Scope Tool* on the *CME 2® User Guide* provided on the CD-ROM shipped with the ICR Plus actuator.

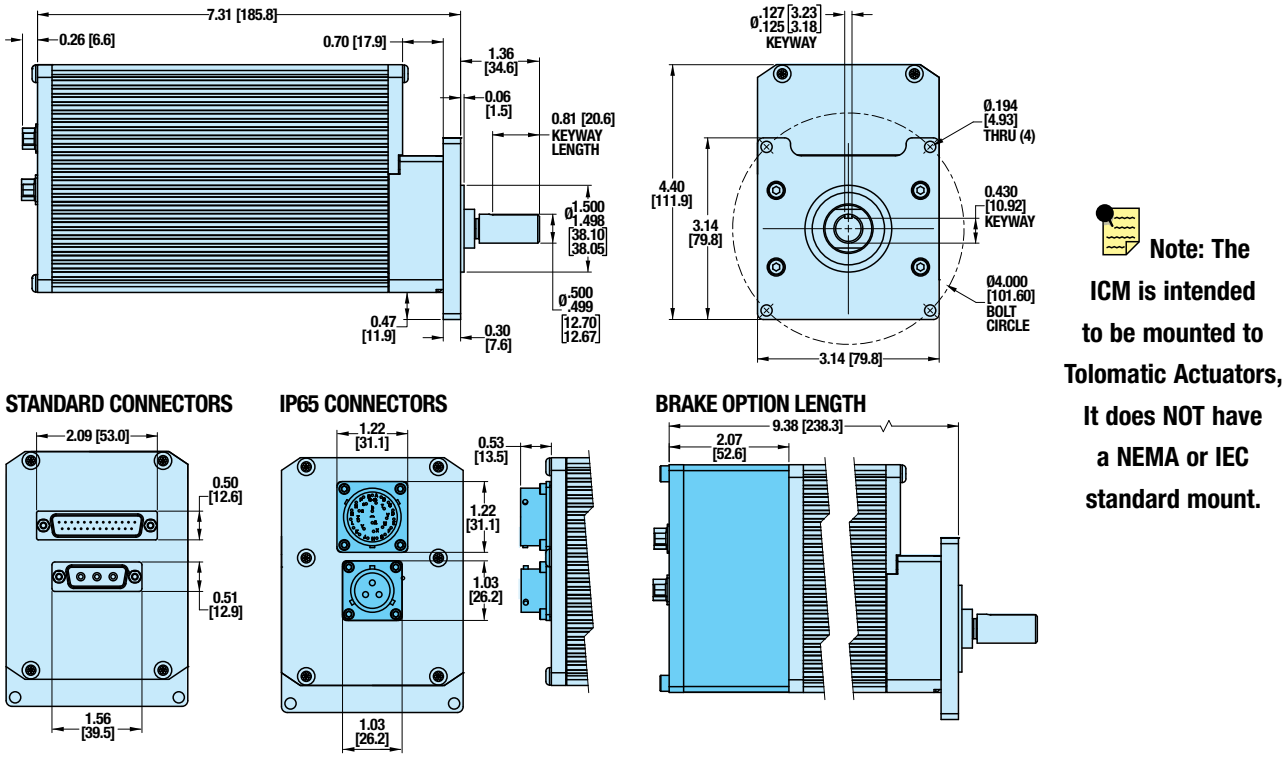
7.1 ICR_LMI SV1B Basic and SV1P Plus Actuator Dimensions



7.2 ICR_RP SV1B Basic and SV1P Plus Actuator Dimensions

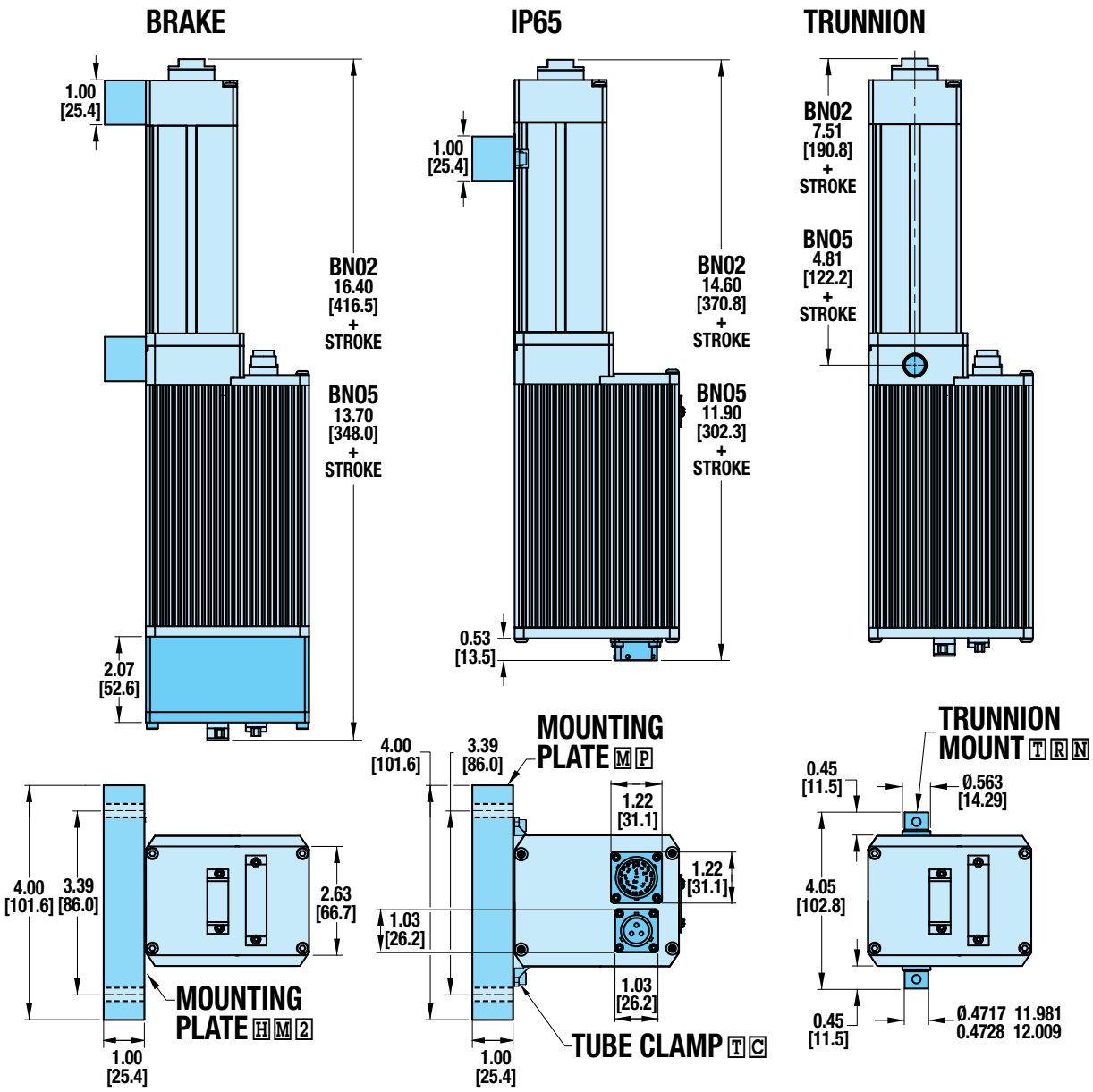


7.3 ICM Plus Dimensions



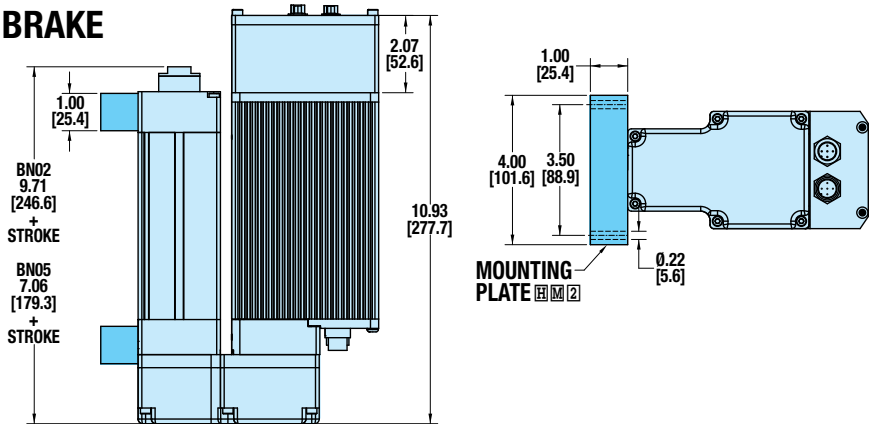
Note: The ICM is intended to be mounted to Tolomatic Actuators, It does NOT have a NEMA or IEC standard mount.

7.4 ICR_LMI SV1B Basic and SV1P Plus Options Dimensions

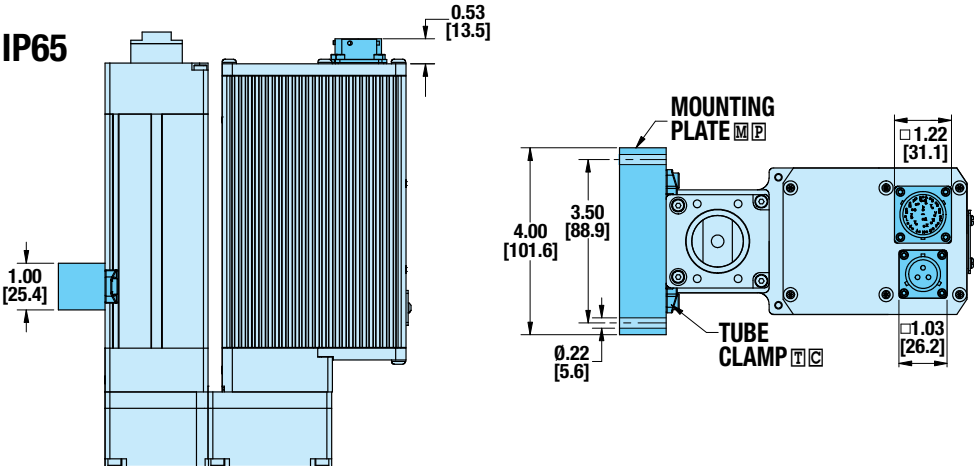


7.5 ICR_RP SV1B Basic and SV1P Plus Options Dimensions

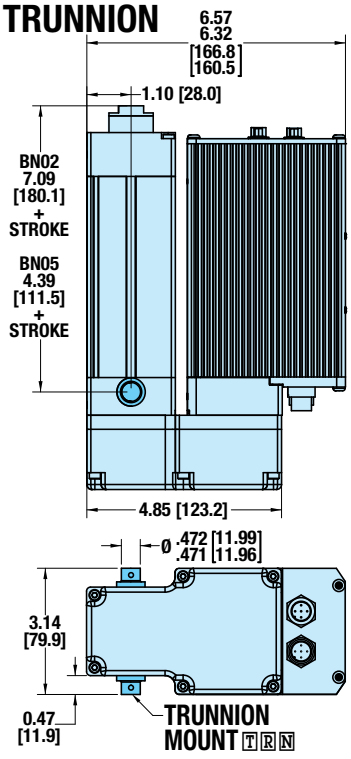
BRAKE



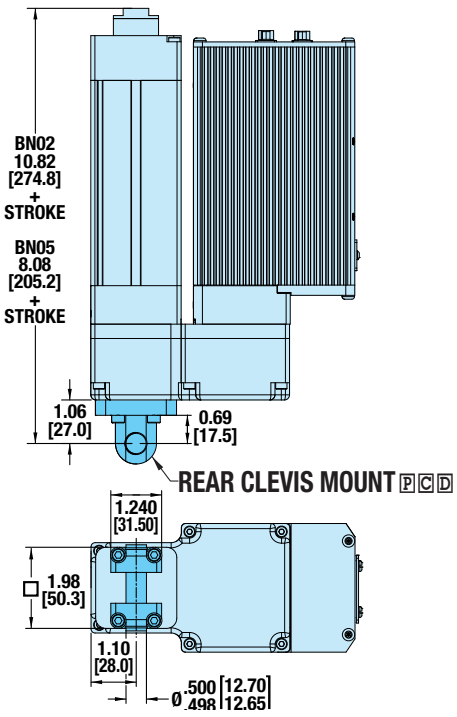
IP65



TRUNNION

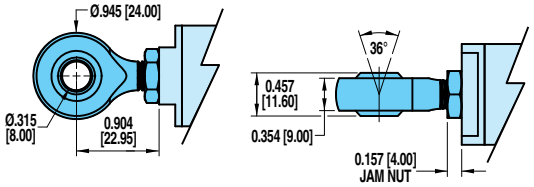


CLEVIS

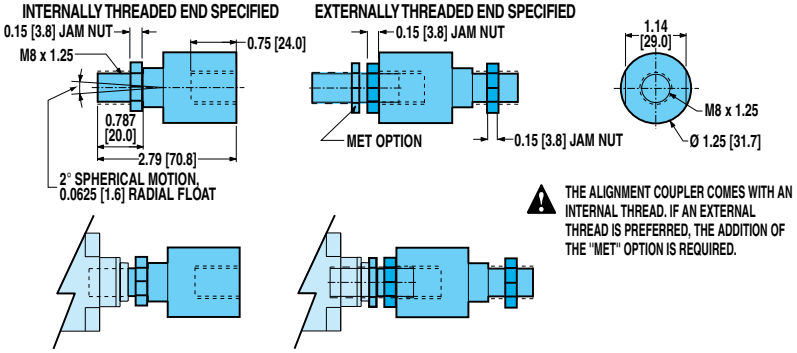


7.6 ICR SV1B Basic and SV1P Plus Rod End and Switch Dimensions

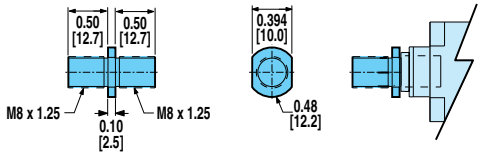
OPTIONAL Spherical Rod Eye End: **SRE**



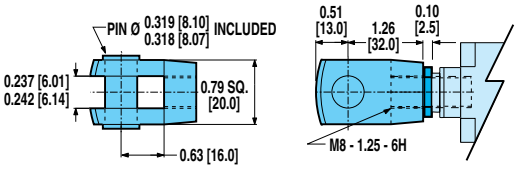
OPTIONAL Alignment Coupler Rod End: **ALC**


INTERNALLY THREADED END SPECIFIED
EXTERNALLY THREADED END SPECIFIED
0.15 [3.8] JAM NUT
M8 x 1.25
0.75 [24.0]
0.787 [20.0]
2.79 [70.8]
2° SPHERICAL MOTION, 0.0625 [1.6] RADIAL FLOAT
0.15 [3.8] JAM NUT
MET OPTION
0.15 [3.8] JAM NUT
1.14 [29.0]
M8 x 1.25
Ø 1.25 [31.7]
THE ALIGNMENT COUPLER COMES WITH AN INTERNAL THREAD. IF AN EXTERNAL THREAD IS PREFERRED, THE ADDITION OF THE "MET" OPTION IS REQUIRED.

OPTIONAL External Threaded Rod End: **MET**

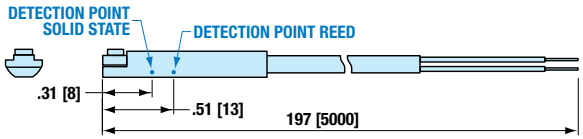


OPTIONAL Clevis Rod End: **CLV**

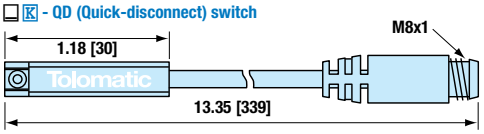


SWITCH DIMENSIONS

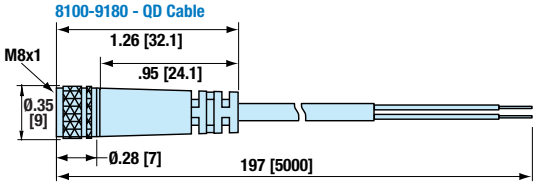
☐ Y - direct connect



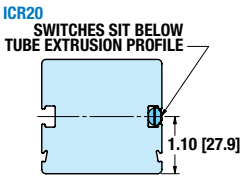
☐ K - QD (Quick-disconnect) switch



8100-9180 - QD Cable



MOUNTING DIMENSIONS



7.7 Maintenance and Inspection

The ICR Basic and Plus SmartActuators are lubricated for the life of the actuator. No additional lubrication is required.

Due to the Controller/Drive/Motor assembly process integral to the ICR actuator, there are no user-serviceable components in the SmartActuator. Disassembly of the actuator is not recommended. ICR SmartActuators should be returned to Tolomatic for evaluation and repair.

Should the return of the actuator be necessary, call our customer service department and ask for a Return Authorization Number. Package the product securely and return to Tolomatic.

Tolomatic, Inc.

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Hamel, MN 55340

1-800-328-2174

763-478-8000

7.8 Product Warranty

Tolomatic, Inc. warrants all products manufactured by it to be free from defects in material and workmanship for a period of one year from date of shipment by Tolomatic. If, within this period, any product is proven to be defective by Tolomatic, the product will either be repaired or replaced at Tolomatic's option.

This warranty shall not apply to:

1. Products not manufactured by Tolomatic. Warranty of these products will conform and be limited to the warranty actually extended to Tolomatic by its supplier.
2. Damage to the product caused by circumstances beyond the control of Tolomatic, such as negligence, improper maintenance, or storage.
3. This warranty shall be void in the case of: any repairs or alterations made to the product by parties other than Tolomatic.

The foregoing warranties are exclusive and in lieu of all other express and implied warranties. Tolomatic is not subject to any other obligations or liabilities for consequential damages.

7.9 Troubleshooting

7.9.1 Troubleshooting the ICR SV1B Basic Actuator

SYMPTOM / TROUBLE	POSSIBLE CAUSE / RESOLUTION
No response from actuator	1. Check power connection for proper cable connection and bus voltage. 2. Verify that the E-stop and Enable are both active. 3. Verify that direction commands are being sent. 4. Verify that the input return is connected to signal ground. 5. Check signal cable for proper connection and wiring.
Actuator cannot move load	1. The load is too large. 2. There is too much friction. 3. Side load is excessive. 4. Push force is set too low. 5. Power supply does not have enough current capability.
Actuator is overheating	1. Ambient temperature is too high. 2. Operation is outside of the continuous ratings. 3. Cooling is insufficient.
Actuator is operating erratically	1. Determine if there is regenerative energy. 2. Determine if push force is set too low. 3. Determine if power supply has enough current. 4. Check for irregularities in the load.

7.9.2 Troubleshooting the ICR/ICM SV1P Plus

SYMPTOM / TROUBLE	POSSIBLE CAUSE / RESOLUTION
No response from actuator	1. Check power connection for proper cable connection and bus voltage. 2. Verify that the Enable signal is active. 3. Verify that the drive is enabled and no faults are present. 4. Verify that the input return is connected to signal ground. 5. Check signal cable for proper connection and wiring.
ICR/ICM cannot move load	1. The load is too large. 2. There is too much friction. 3. Side load is excessive. 4. Power supply does not have enough current capability. 5. Current limits are set too low.
ICR/ICM is overheating	1. Ambient temperature is too high. 2. Operation is outside of the continuous ratings. 3. Cooling is insufficient.
Communication does not work with RS232 to USB converter or communication hangs	1. Close CME 2® and disconnect the communication cable from the actuator. 2. Verify that all drivers for the converter are up to date. 3. Open CME 2®. 4. Wait for the “error Opening Serial Port” message and click OK. 5. Plug communication cable into the actuator. 6. Click on the designated COM port from the main page. 7. Verify all cabling if problems persist.
ICR/ICM is operating erratically	1. Determine if there is regenerative energy. 2. Current limit is set too low. 3. Following error is set too low. 4. Determine if power supply has enough current. 5. Check for irregularities in the load.

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